ENGINEERING AND
# BOILER HOUSE REVIEW

ESTABLISHED 1899

TWO SHILLINGS & SIXPENCE

VOL. 73 NO. 11 • THE PIONEER STEAM JOURNAL • NOVEMBER, 1958

**Now also for low pressure steam plants!**

Normal design with fixed phial.

Special design with capillary tube and loose phial, which can be used where the natural air circulation is checked.

Special design for covered radiators.

**SAVE FUEL**

A simple and lasting solution. It is a question of getting the fuel to go as far as possible.

Do it with

Danfoss **thermostatic radiator valve**

- Great sensitivity
- Economical operation of the plant
- Easy operation
- No stuffing box
- Phial unit can be interchanged without draining of the system
- Will prevent freezing
- Temperature range between 37.4 F. and 77 F.

The Danfoss Thermostatic Radiator Valve is provided with an adjustable temperature scale and is constructed so that each radiator is regulated separately. It can be used for all central heating plants and gives a new feeling of comfort as well as a considerable saving of fuel.

With a Danfoss Thermostatic Radiator Valve you determine the temperature.

Write for the brochure Q 13-002 containing detailed information.

everything under Danfoss control

DANFOSS AUTOMATIC CONTROLS AND EQUIPMENT
13, Queensway, London, W.2. Telephone BAYswater 9321

*This is one of a series of advertisements by* ***RITCHIE CALDER*** *which is appearing in the National Press to illustrate how atomic power may help man's muscle emancipation*

# Muscle is the most costly power on earth

A TYPICAL SCENE in tropical countries is that of the bullock-team raising water from a well. To the chanting of the drivers, the bullocks trudge backwards and forwards, under the relentless sun, lowering the buckets into the well, hoisting the water and tipping it into the water-courses to irrigate the thirsty soil, from which both men and beasts get their food. Those peasants are poor, despairingly poor, yet they use the most expensive power in the world—muscle-power. Bullocks have to be bought, tended and fed, yet even with the meagre food and pitiful earnings of the men who drive them, the energy equivalent which they produce costs twenty times as much per unit as the energy output at Calder Hall atomic energy station.

## MUSCLE POWER INEFFICIENT

A great many people in the world are poor because of necessity, they use calories in their most expensive form and energy in the most uneconomical way. Although we may glorify muscle-effort—and, indeed, laud it in the performances of athletes—it is deplorably inefficient. The advance from the steam-engine to atomic power, from the pulley-belt to automation, has represented the emancipation of man from muscle-slavery.

The paradox of power is that those who are power-deficient are power-extravagant. When we go around the house switching off lights to keep the electricity bill down, we might think of the Indian villager burning cow-dung to cook his food for his muscle-power. Because he burns that dung, instead of using it as manure, his soil is undernourished, his crops are undernourished, and he is undernourished.

This is the Misery-Go-Round of poverty; because the peasant is poor he is undernourished; because he is undernourished he under-produces; because he under-produces he is poor; and because, in 'muscle-power' countries, poverty prevails, their natural resources are underdeveloped. Such countries see in nuclear energy a break-through to industrial prosperity. The problem of how to find the money to pay for it and to train the people to handle it, is the answerable challenge of our times.

The power engineers know the answers; the mechanical engineers have created the machines. The muscle-slaves are waiting to be freed and the resources of their countries are waiting to be developed. The machine is the emancipator.

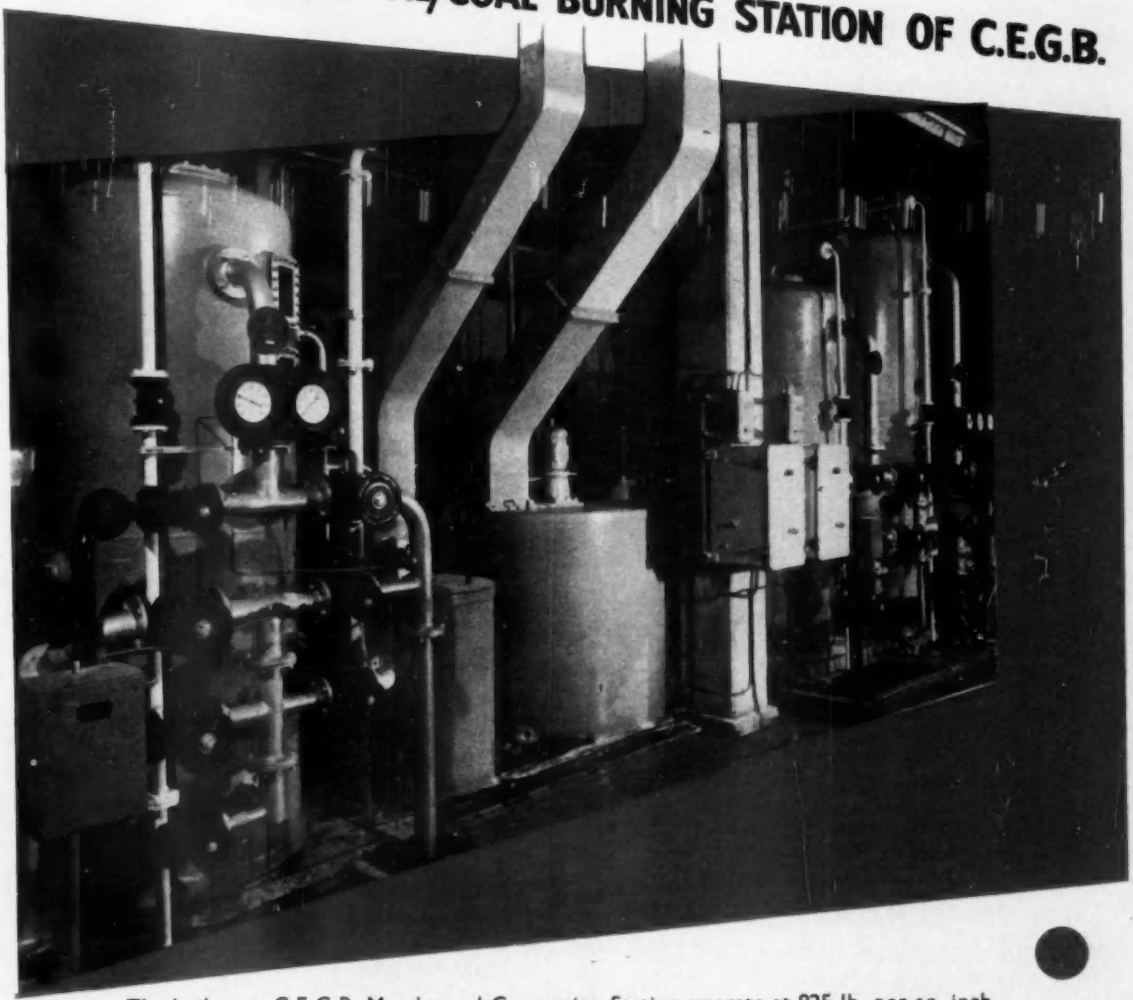
***MITCHELL ENGINEERING*** *are designing and constructing Nuclear Power Plant to meet world needs in the New Atomic Age*

MITCHELL

MITCHELL ENGINEERING LIMITED ONE BEDFORD SQUARE LONDON

# PERMUTIT

## FOR FIRST OIL/COAL BURNING STATION OF C.E.G.B.



The boilers at C.E.G.B. Marchwood Generating Station operate at 925 lb. per sq. inch, and are provided with "Deminrolit" treated make up feed.

There is no split responsibility with a "Deminrolit" Plant because The Permutit Company design and manufacture the Plant, also develop and manufacture their own Ion Exchange Resins. This is exclusive to Permutit.

## THE PERMUTIT COMPANY LIMITED

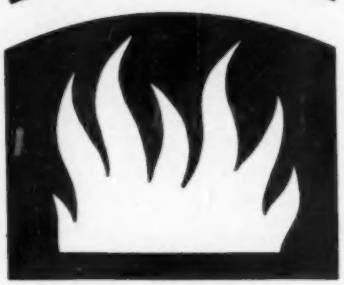
DEPT. T.H.317, PERMUTIT HOUSE, GUNNERSBURY AVENUE, LONDON, W.4 · TELEPHONE: CHISWICK 6431

# WHITE CALCIUM-ALUMINATE CEMENT

(Over 70% $Al_2O_3$)

IRON COMPOUNDS & SILICA LESS THAN 1%

SECAR



250

Registered Trade Mark

This cement when mixed with appropriate aggregates provides Super-duty Castable Refractory Concrete for service temperatures up to 1,800°C (3,300°F) Refractory Concrete free from Iron Compounds & Silica is now possible for the first time.

A REFRACTORY CONCRETE FOR ANY PURPOSE

## SECAR 250

**is a product of**

**Lafarge Aluminous Cement Co. Ltd.**

*Manufacturers of*

CIMENT FONDU

Regd Trade Mark

ALUMINOUS CEMENT

**BECAUSE**

Almost the entire Refractory field can be covered by Refractory Concretes based on SECAR 250 or CIMENT FONDU.
SECAR 250 concretes have all the well known properties of Ciment Fondu concretes

**PLUS**

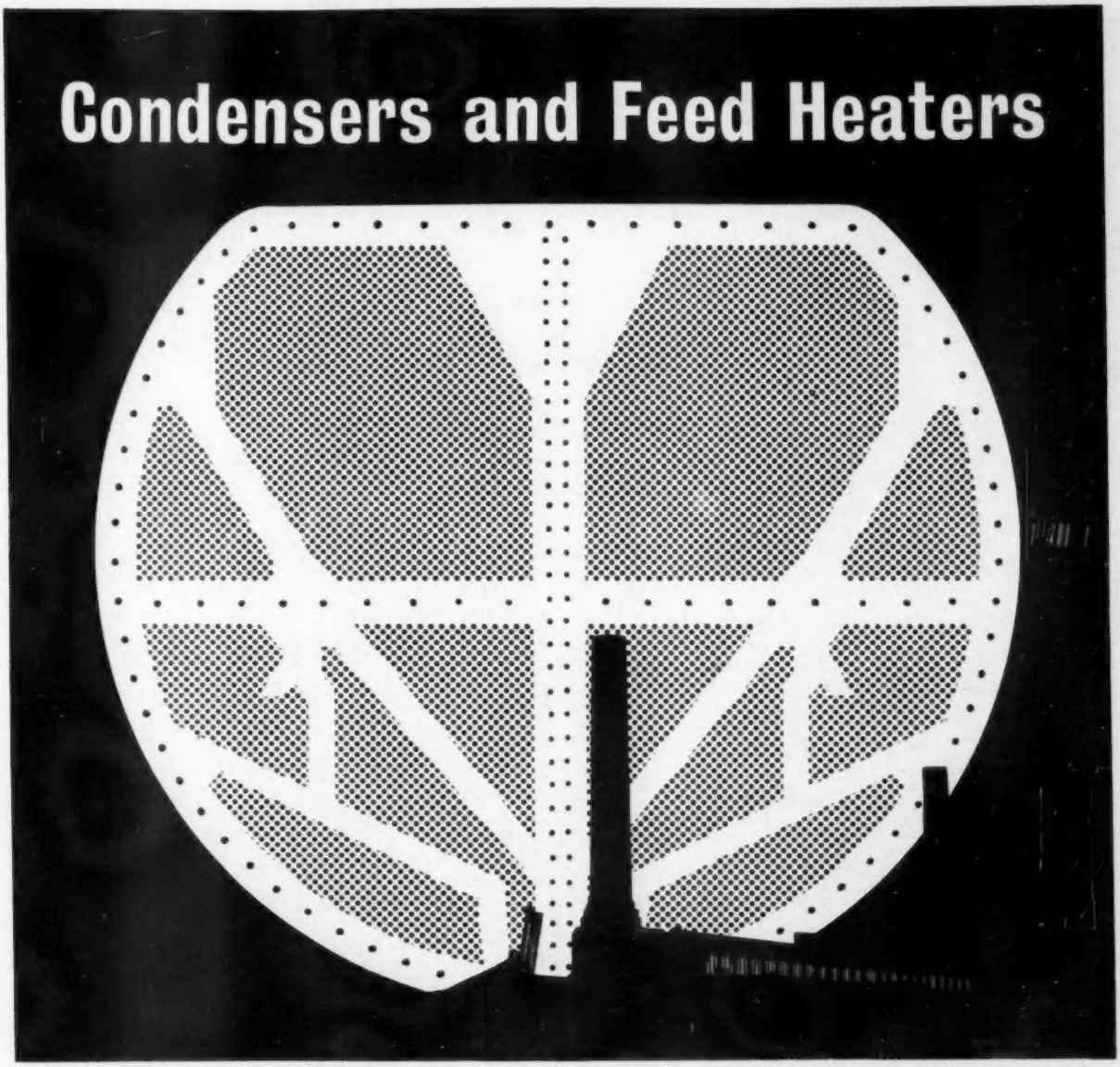
- **HIGH PURITY**
- **HIGH REFRACTORINESS**
- **HIGH SLAG RESISTANCE**
- **HIGH COLD STRENGTH**
- **HIGH SPALLING RESISTANCE**
- **HIGH CASTING ACCURACY**
- **HIGH RESISTANCE TO CORROSIVE ATMOSPHERES**
- **NO SPECIAL PRE-FIRING PROCEDURE**

**WRITE FOR BOOKLETS 'SECAR 250' AND 'REFRACTORY' CONCRETE**

**LAFARGE ALUMINOUS CEMENT CO. LTD.** 73, BROOK STREET, LONDON, W.1. TEL.: MAYfair 8546

AP/48

# Condensers and Feed Heaters



Our fabricating shops at Hartlepool are equipped to build the largest power station condensers, and in the same works we build feed heaters, air ejectors, de-aerators and rotary cooling water strainers.
Also at Hartlepool we are equipped to build steam turbines and alternators up to 275MW output, gas turbines, centrifugal and axial-flow blowers, all of Brown Boveri design; and also water-tube boilers of Foster Wheeler design for evaporating up to a million pounds of steam per hour.
In fact we can supply all the main items for a power station; from an industrial unit, designed to run on by-product fuels or waste heat, to the largest public supply station.

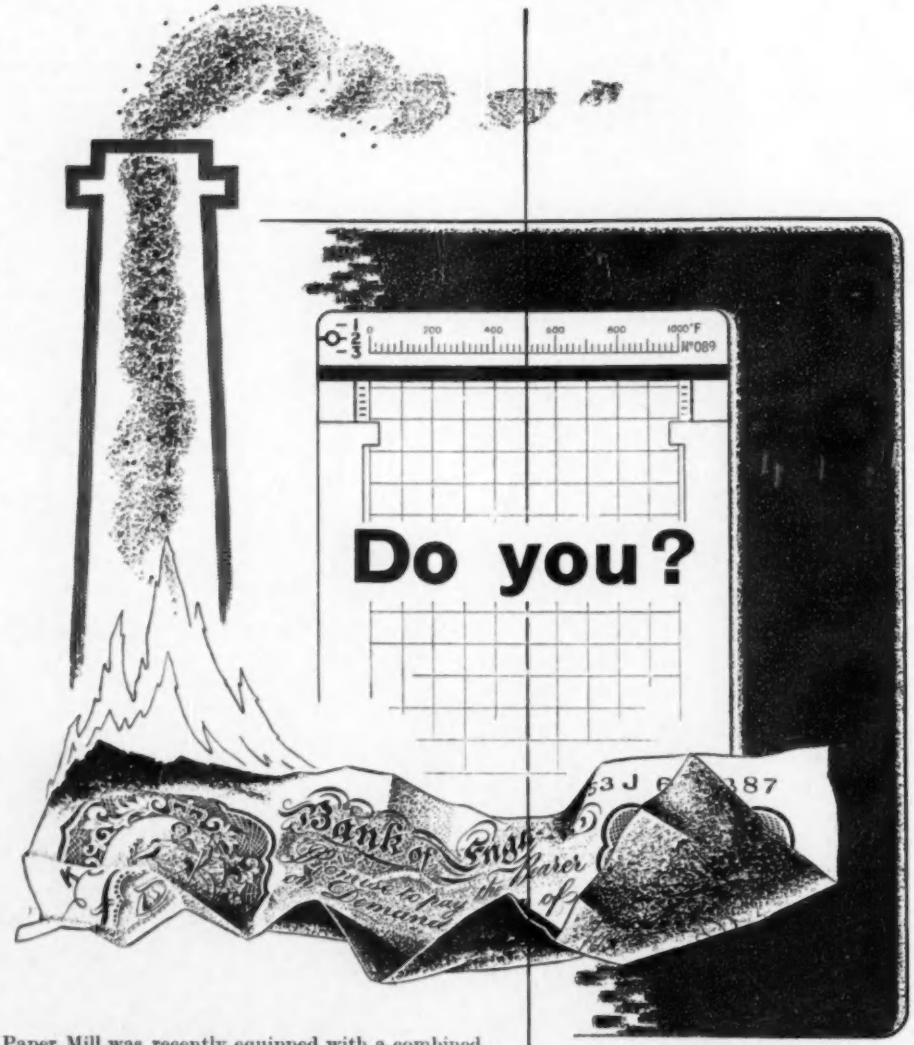
## Richardsons Westgarth (HARTLEPOOL) Ltd.

R W G

**A member of the RICHARDSONS WESTGARTH GROUP which co-ordinates the land and marine activities of:**

THE NORTH EASTERN MARINE ENGINEERING CO. LTD.
PARSONS MARINE TURBINE CO. LTD.
GEORGE CLARK & NORTH EASTERN MARINE (SUNDERLAND) LTD.
RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.
THE HUMBER GRAVING DOCK & ENGINEERING CO. LTD.
RICHARDSONS WESTGARTH ATOMIC LTD.
ASSOCIATED COMPANY: ATOMIC POWER CONSTRUCTIONS LTD.

**RICHARDSONS WESTGARTH (HARTLEPOOL) LTD., HARTLEPOOL, Co. DURHAM.**
**And at: 58 Victoria Street, London, S.W.1. 59 Mosley Street, Manchester, 2. 75 Buchanan Street, Glasgow, C.1.**



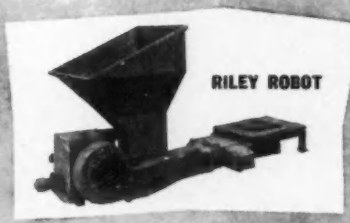

A Paper Mill was recently equipped with a combined installation consisting of a N & Z multi-point Indicating Pyrometer, recorder and a plug selector switchbox for use on a battery of ten Lancashire Boilers. The installation discovered a heat loss of 13%. Within three months this figure had been reduced by 3.7%. Average weekly fuel consumption at the Mill is 500 tons of coal, and 3.7% of that represents an amount of money that no one could afford to burn.

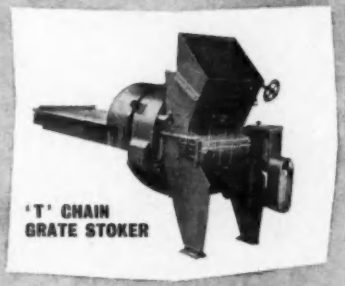
**For Boiler House instrumentation consult:-**

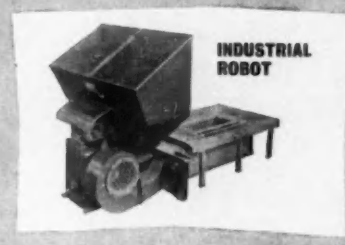
## NEGRETTI & ZAMBRA

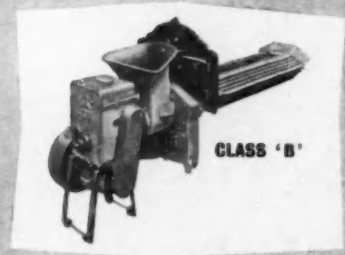
Manufacturers of instruments for the indication, recording, controlling of: Temperature, pressure, liquid level, volume, specific gravity, humidity, etc.

NEGRETTI & ZAMBRA LTD · 122 REGENT STREET · W.1






# IT IS AN OFFENCE TO EMIT DARK SMOKE

Under the Clean Air Act it is now an offence to emit dark smoke. The problem of ensuring smokeless combustion within the meaning of the Act without costly conversions can be solved by the installation of Riley Chain Grate or Under-feed Mechanical Stokers. Write for full technical information.

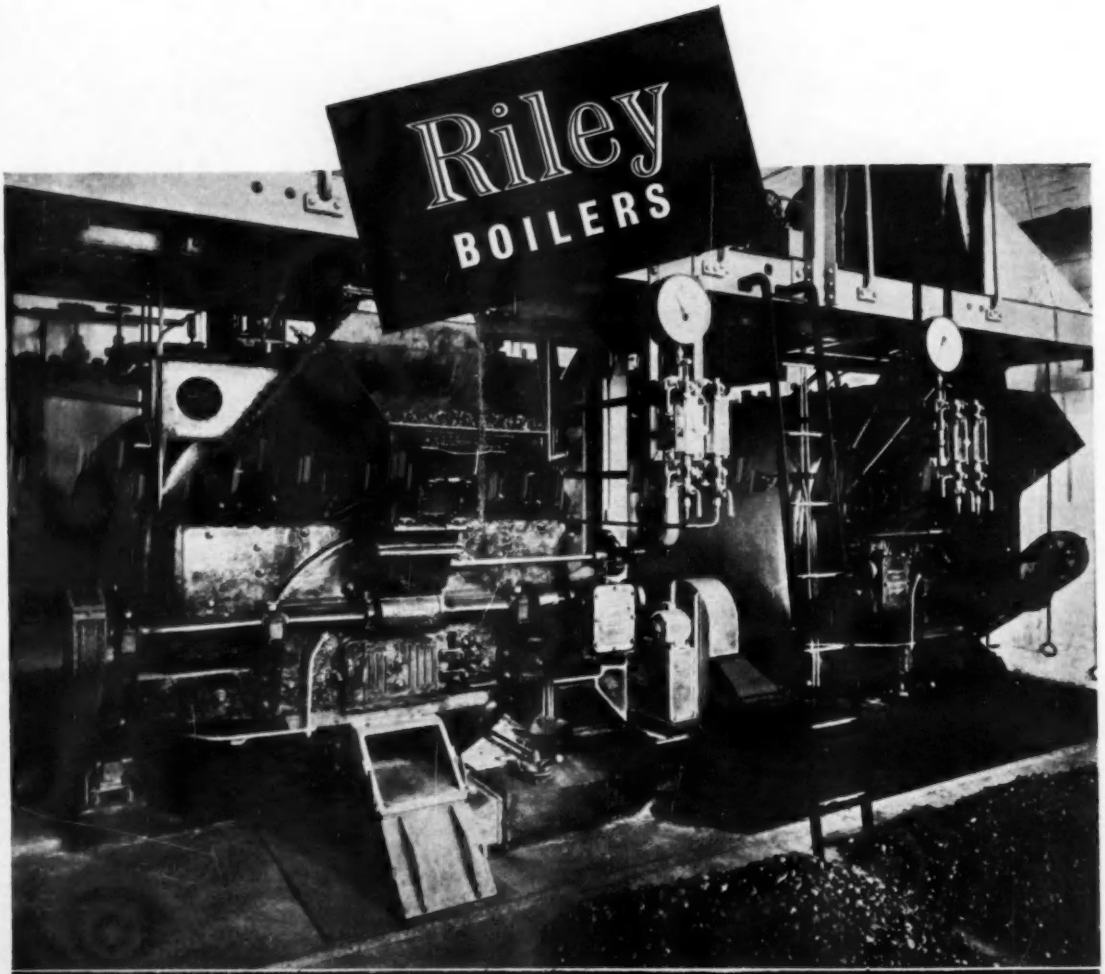
## all these RILEY STOKERS provide smokeless combustion from small bituminous coal

**RILEY (IC) PRODUCTS LIMITED**

*Mechanical Stokers. Syntron Electric Vibratory Equipment*
*A Member of the International Combustion Organisation*

NINETEEN WOBURN PLACE - LONDON WC1 - TERMINUS 2822

TGA 1566




*for* ***Craftsmanship and Dependability***

*Installation of* ***FUEL SAVING ECONOMIC type BOILERS***

*Manufactured by*

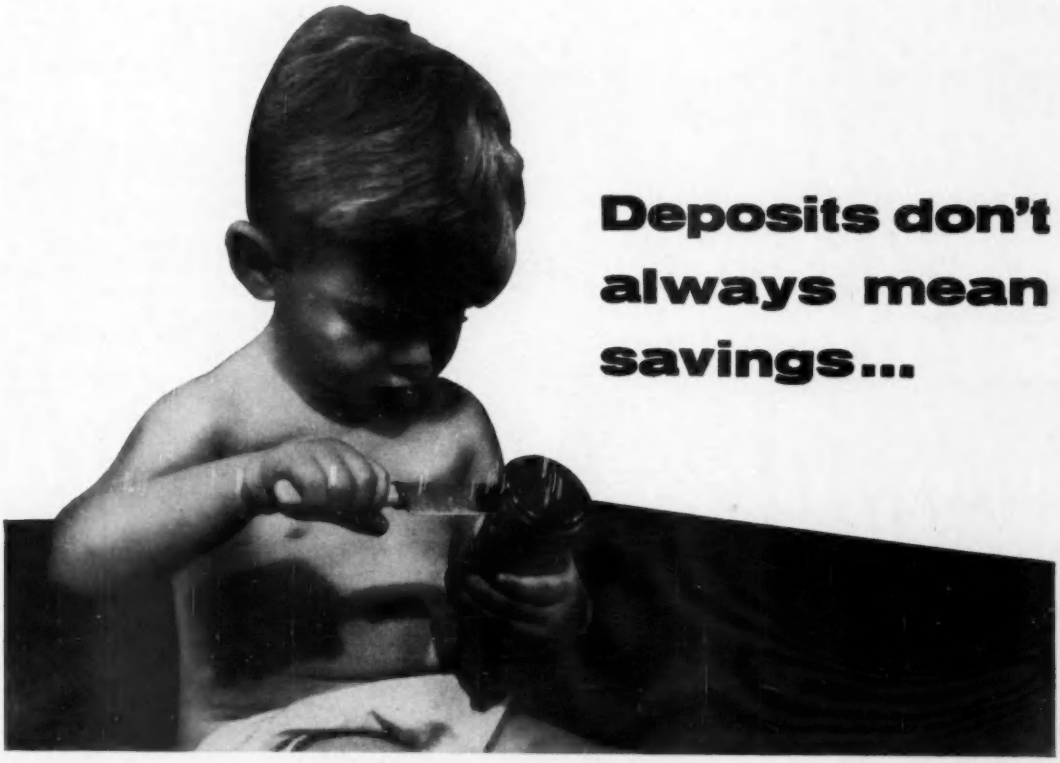
**STOCKTON CHEMICAL ENGINEERS & RILEY BOILERS LTD.**

PERSEVERANCE WORKS, STOCKTON-ON-TEES

*Tel:* 67841 *Telegrams:* "Boiler" Stockton-on-Tees

*Also makers of:-*

**VERTICAL LANCASHIRE, MARINE AND WASTE HEAT BOILERS, STEEL CHIMNEYS, VESSELS AND TANKS**



# Deposits don't always mean savings...

Carbonaceous deposits, for example, in oil-fired heating systems result in wasted fuel and loss of heat transfer. FUELSLIP fuel oil additive contains a combustion catalyst which makes it possible to burn *completely* the products of incomplete combustion and so avoid their binding action on carbonaceous matter thus eliminating the cause of malignant deposits. This in turn results in a reduction in the amount of water absorbed and thus corrosive sulphuric acid formation is minimised. All this means that you enjoy increased fuel efficiency *and* economy!

We shall be pleased to supply you with fully descriptive literature and give you the name of your nearest Slip distributor There are Slip Agents all over the world ready to advise and serve your overseas interests.

**Fuelslip**

FUELSLIP is backed by a comprehensive technical service to help you use your fuel productively. Knowing the causes for lack of fuel efficiency to be many and varied, Slip's extensive laboratories give careful consideration to the conditions of each individual user. Thus Slip are able to ensure that *you* make the most of the fuel that *you* burn.

THE SLIP GROUP OF COMPANIES. 34 GREAT ST. HELENS, LONDON, E.C.3.

Telephones: AVEnue 1636/8 TELEX: 23755 LDN · CABLES: Slipovaces, London.

# tailor-made to each job!

MULTIRAIL fabricated steel handrail standards have proved to be as rigid as the solid forged type, with the advantages of four ferrules enabling vacant ferrules to be used in carrying power lines, air and gas pipes, etc.

**MULTIRAIL**
**fabricated steel handrail standards**

"SAFETREAD" FLOORING IS

**welded for extra strength**

Tailor-made and not just cut to fit, 'Safetread' flooring is no dearer to specify than ordinary steel flooring, but provides maximum strength with minimum of materials; non-skid surface; 82% light and air penetration; a neat-fitting, clean appearance.

**SAFETREAD**
**WELDED FLOORING**

Write for detailed literature to

**Allan Kennedy** & CO LTD
MARITIME STREET · STOCKTON-ON-TEES

Tel: Stockton 65464 (4 lines). Grams: Grating, Stockton-on-Tees. Also at 207 Victoria Street, London, S.W.1

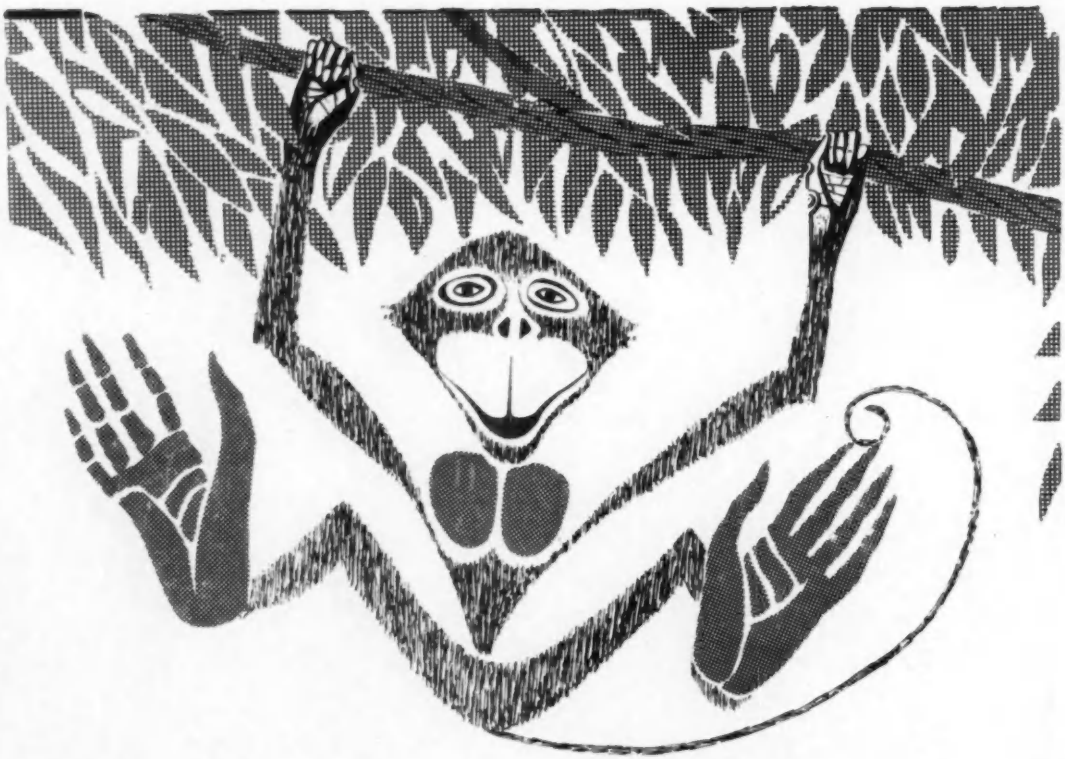
# REAVELL ASKANIA REGULATORS

★

**Combustion control for Boilers and Furnaces of all types, Pressure, Vacuum, Mixture and Temperature Regulators for Gases, Steam, Air, Liquids, for Gas Works, Coke Ovens, Boiler Plant, Steel and Chemical Works, and Industrial Plants Generally**

*Write for particulars, mentioning this journal*

**REAVELL & Co. Ltd.**
**RANELAGH WORKS, IPSWICH**



# He would just say 'nuts' to it!

The problem of boiler corrosion is not a thing to be dismissed lightly though. It is too costly in its effects. But the remedy need not be. "Apexior Number 1"—as used by leading manufacturers of boilers and all steam raising plant for over 50 years—is absolute proof against corrosion where wet temperatures of 175° to 1000°F are encountered. At least 12 months' protection is assured with a double coat of "Apexior Number 1"—mechanically or brush applied. After the initial treatment only one coat is necessary. This also eliminates problems that are presented by scale (danger of damaging boilers by excessive chipping), as Apexiorised surfaces do not support deposits firmly; scale is looser—more easily removed.

In certain industries it is a most important advantage of "Apexior" that it does not affect water by taste, taint or smell. Be guided by half a century's experience—send for your copy of the "Apexior Manual".

DAMPNEY'S APEXIOR REGISTERED

**BRITISH PAINTS LIMITED**

**APEXIOR DIVISION**

PORTLAND ROAD, NEWCASTLE UPON TYNE, 2.
CREWE HOUSE, CURZON STREET, LONDON, W.1.
31, WAPPING, LIVERPOOL, 1.

*SYDNEY · ADELAIDE · TORONTO · DURBAN · CAPE TOWN*
*CALCUTTA · TRINIDAD · NEW YORK · ARKLOW*

**Our world-wide service is at your disposal for the asking**

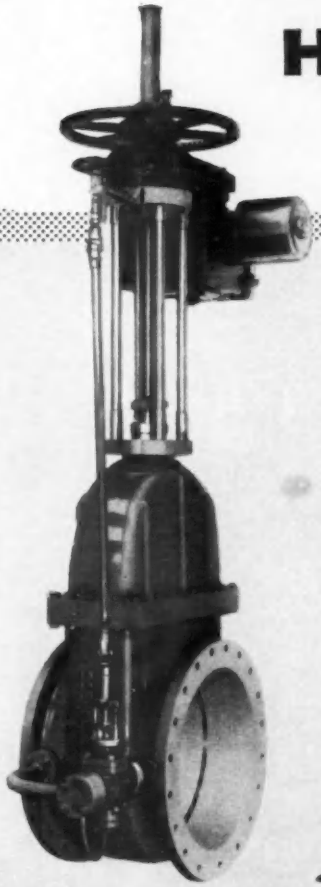
**"APEXIOR NUMBER 1" PREVENTS CORROSION IN STEAM-RAISING PLANT**

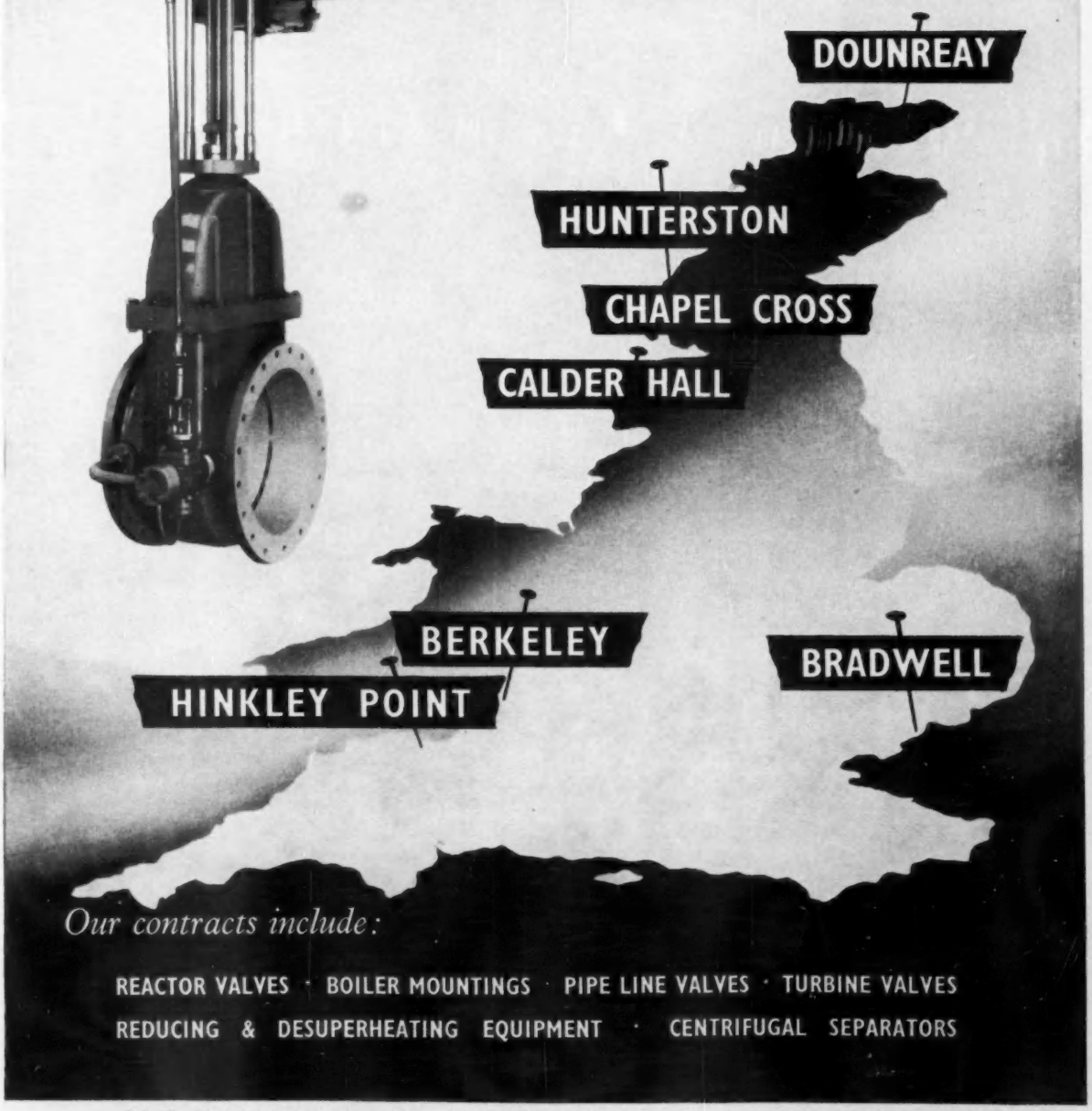
But for cold-wet surfaces up to 125°F.—use "APEXIOR NUMBER 3"

BPL/A35

*Wherever there is Nuclear Progress, there are*

# HOPKINSONS' VALVES






*Our contracts include:*

REACTOR VALVES · BOILER MOUNTINGS · PIPE LINE VALVES · TURBINE VALVES
REDUCING & DESUPERHEATING EQUIPMENT · CENTRIFUGAL SEPARATORS

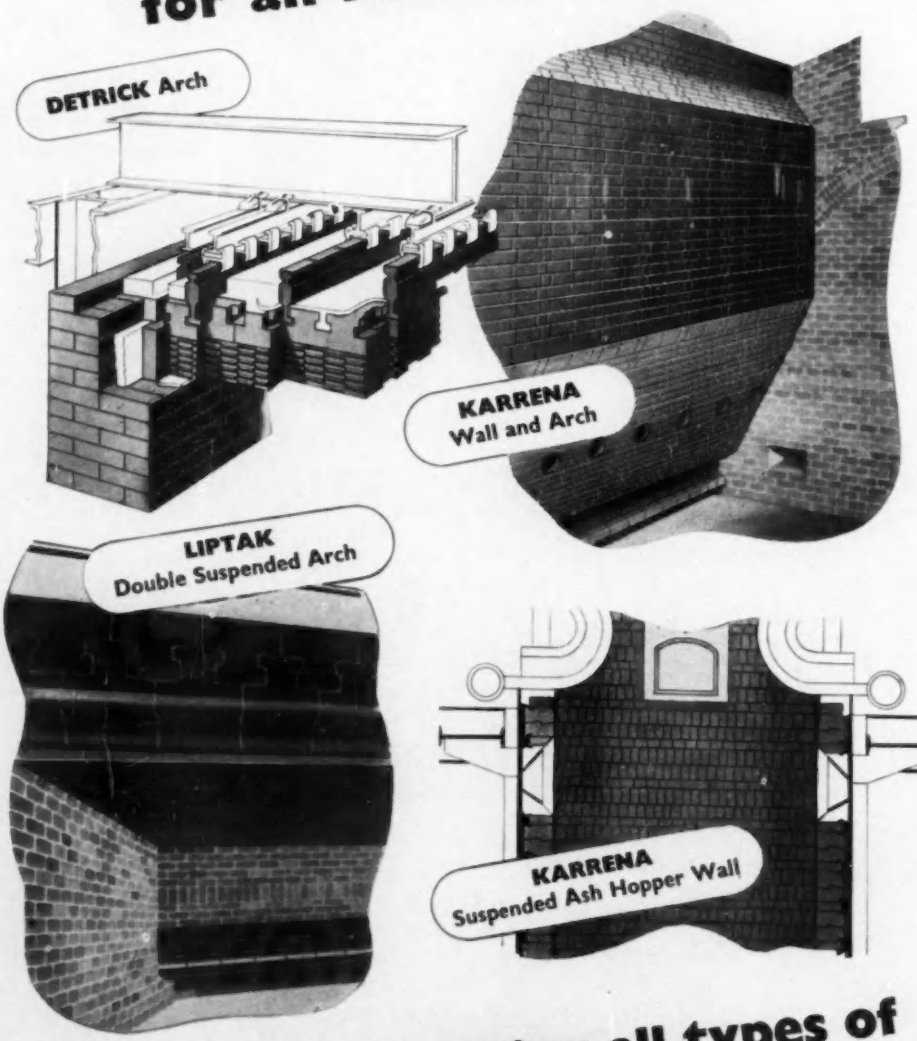
**HOPKINSONS LIMITED · HUDDERSFIELD**

LONDON OFFICE: 34 NORFOLK STREET · STRAND · W.C.2

HV 109

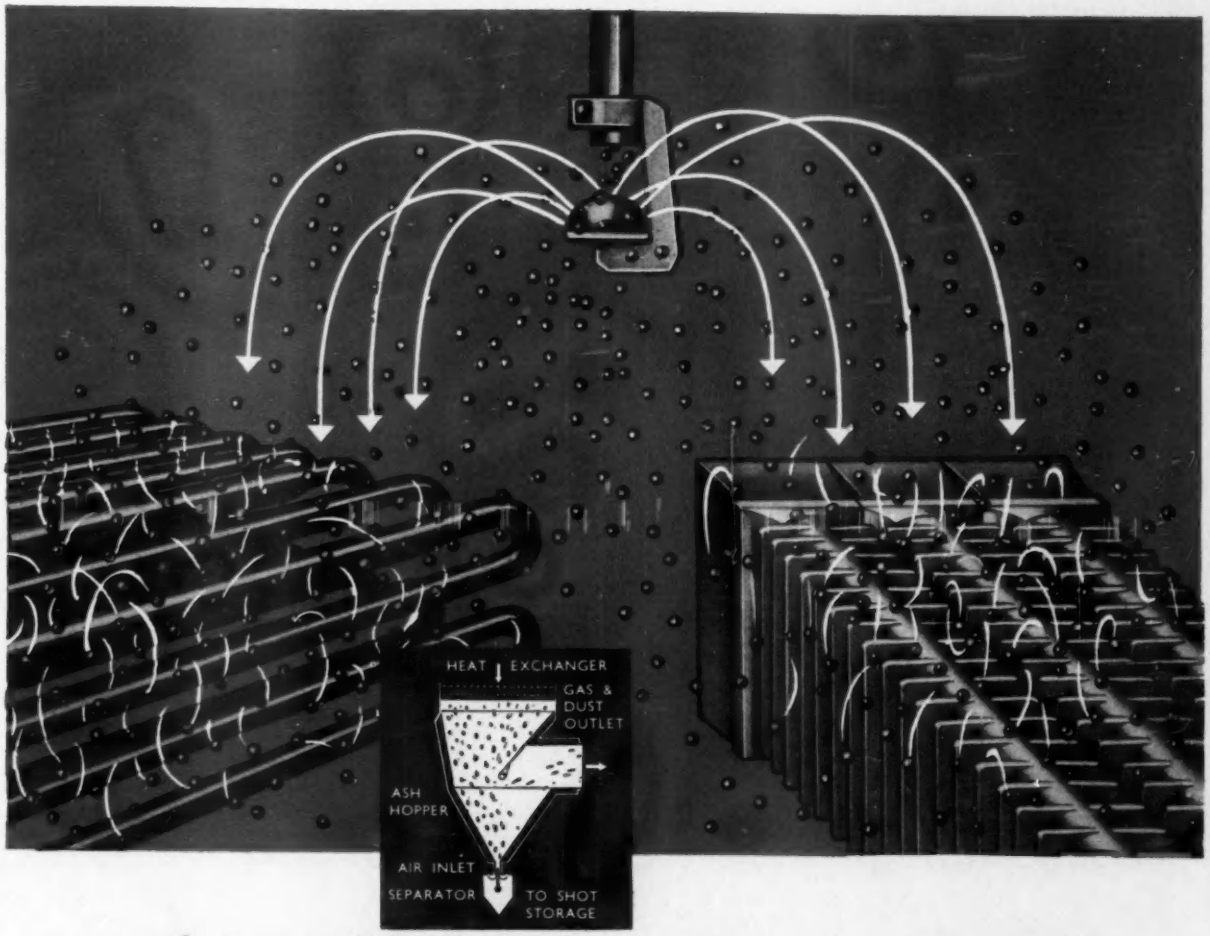
# GLENBOIG FIREBRICKS

## for all Industrial Purposes...




## ...including all types of SUSPENDED WALLS and ARCHES

THE GLENBOIG UNION FIRE CLAY CO LTD · GLENBOIG · LANARKSHIRE · SCOTLAND
Export Agents GENERAL REFRACTORIES LTD · GENEFAX HOUSE · SHEFFIELD 10




# *Shot Cleaning* maintains constant temperature in heat exchangers at all times

**GET MAXIMUM EFFICIENCY from new heat exchangers; recover lost power from old. Install the KEITH BLACKMAN-BROMAN EKSTROM SHOT CLEANING SYSTEM which, irrespective of fuel (coal, oil, waste heat, sulphite, sulphate liquor or creosote pitch), offers many indisputable advantages:**

SHOT CLEANING maintains continuously, constant temperature in the boiler, economiser or preheater—by dislodging deposits from heat transfer surfaces *before* thermal efficiency or boiler draught is affected.

SHOT CLEANING acts with the boiler under full load —no shut down, no dampering back. It ensures plant availability all the time—requires no outages for cleaning.

SHOT CLEANING is a dry cleaning method—no steam, no air, no water is introduced to affect the dew point of gases, as in conventional methods.

SHOT CLEANING permits the installation of the right size heat exchanger—no need now for the larger than necessary plant which allows for gradual decline in efficiency.

SHOT CLEANING has proved its effectiveness in POWER STATIONS, GAS WORKS, FOUNDRIES and other INDUSTRIAL PLANTS throughout the world including Europe, U.S.A., Canada, U.S.S.R., Japan and India. Your enquiry benefits from the experience gained from the installation of hundreds of such plants.

IN BRIEF. Shot cascades evenly over the cross-sectional area of the tubes. It ricochets from tube to tube, plain or gilled, dispersing undesirable deposits before they can accumulate. The shot is pneumatically recirculated just as long as is necessary to keep heating surfaces clean—generally about 20 minutes during any 8 hour shift. Simplicity of the system is reflected in the extremely low operating and maintenance costs. Installation costs too are often far less than with conventional cleaning methods.

## KEITH BLACKMAN - BROMAN EKSTROM *Shot Cleaning*
## PROMOTES MAXIMUM HEAT TRANSFER

*Write now for descriptive Publication 35/10*

**Keith Blackman Ltd** MILL MEAD ROAD · LONDON · N.17

*Incorporating Blackman Export Co. Ltd.*

*and at Birmingham · Bristol · Glasgow · Leeds · Leicester · Manchester · Newcastle-on-Tyne*

881

# New Landmarks

## IN BOILER DESIGN

240,000 lb/hour at 3,300 p.s.i. and 1,060°F

860,000 lb/hour at 1,600 p.s.i. and 1,010°F

Simon-Carves Ltd have broken new ground with two recent orders for boiler plant.
At Margam, for the Steel Company of Wales, they are building a once-through forced circulation boiler to generate 240,000 lb of steam per hour at 3,300 p.s.i. and 1,060° F with reheat to 840° F.
This is the first Benson-type boiler to be built in Britain and the steam conditions are the most advanced ever commercially used in this country.
At the Padiham 'B' power station of the Central Electricity Generating Board Simon-Carves are to build a 120-MW reheat boiler unit of the continuous-slagging type.
This unit, which will generate 860,000 lb per hour of steam at 1,600 p.s.i. and 1,010° F with reheat of 785,000 lb per hour to 1,005° F, will be one of the first, if not actually the first, of this type to be built in this country.
It will convert the whole of the ash and the dust into slag and thereby both avert the nuisance of handling and disposing of fine ash and produce a usable product.
At the same time, Simon-Carves are busy at home and abroad on the design and construction of conventional boiler plant—a speciality in which they have long played a leading part.

*Complete power plant*
*by* ***Simon-Carves Ltd***

SIMON ENGINEERING GROUP

STOCKPORT, ENGLAND

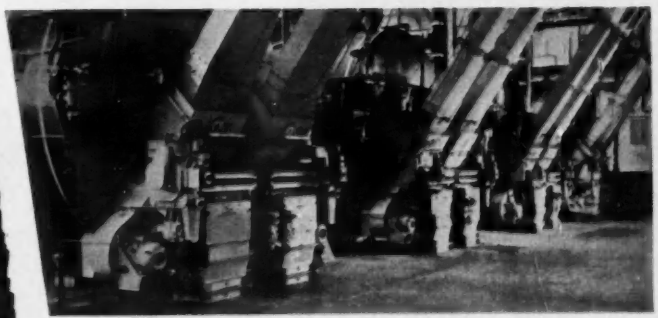
OVERSEAS COMPANIES | *Simon-Carves (Africa) (Pty) Ltd: Johannesburg* *Simon-Carves (Australia) Pty Ltd: Botany, N.S.W.*

SC181

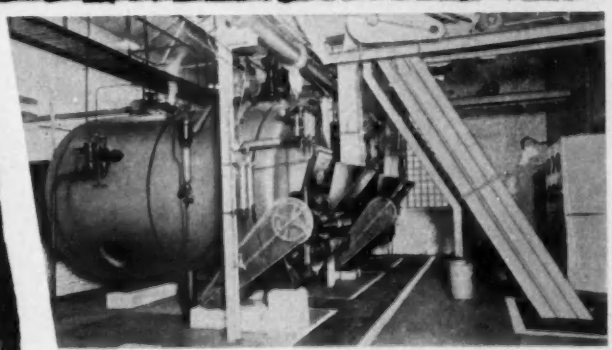
Is your problem smoke prevention?

# Clearly BENNIS have the answer –in fact **two** answers!

With the CHAIN GRATE and "LOW RAM" Stokers for the firing of shell type and small water tube boilers Bennis offer two machines which give not only freedom from legislative action but a new economy. For smokeless combustion, higher thermal efficiency and fuel economy with maintenance costs reduced to a minimum, the answer is clearly BENNIS.



Bennis Chain Grate Stokers fitted to Economic boilers.



"Low Ram" Stokers fitted to Ruston & Hornsby Horizontal "Thermax" Economic boilers.

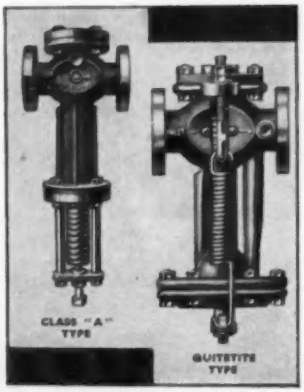
We can also supply Oil Fuel Burners and Auxiliary equipment with complete erection, pipework and storage tanks.

**BENNIS**
**COMBUSTION LIMITED**

LITTLE HULTON, WALKDEN, MANCHESTER
Telephone: WALkden 3213/4/5

*LONDON OFFICE:* Brettenham House, Lancaster Place, Strand, W.C.2.
Telephone: COVent Garden 1512

*ONE OF THE HODGKINSON GROUP OF COMPANIES*




TELEPHONE No.: BRIDGETON 2124
TELEGRAMS: "REDUCING" GLASGOW

# Auld's Patent Reducing Valves

**FOR ALL DUTIES**

*ON STEAM, AIR, OR WATER SERVICES*

*Also Manufacturers of*

SURPLUS VALVES, COMBINED SURPLUS AND REDUCING VALVES
FULL BORE RELIEF VALVES, STOP VALVES, DE-SUPERHEATERS
STEAM TRAPS, ETC. FOR ALL PRESSURES AND TEMPERATURES

AULD

**DAVID AULD & SONS LTD., WHITEVALE FOUNDRY, GLASGOW, S.E.**

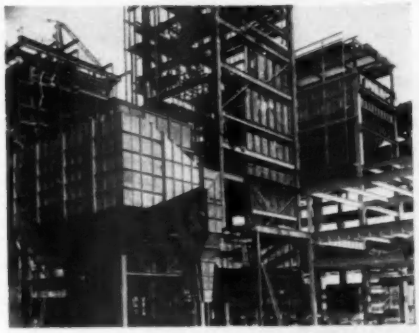
# There are many different ways of collecting dust!

Why prospect? You can depend on a Musgrave Installation . . . A Simple Cyclone . . . Bag Filters . . . Wet Collectors . . . Mechanical Collectors . . . Electric Precipitators. If you have a Dust problem you can do no better than specify MUSGRAVE.

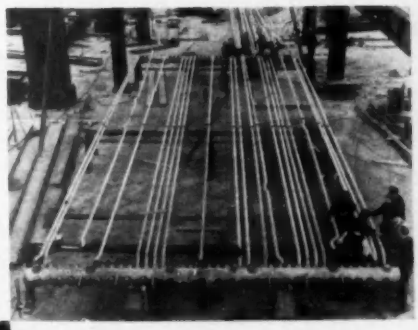
**MUSGRAVE** AND CO. LTD.

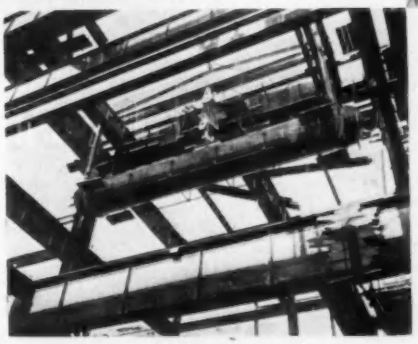
**ST. ANN'S WORKS, BELFAST, NORTHERN IRELAND**

| | | | |
|---|---|---|---|
| 297 Hagley Road BIRMINGHAM 16 | 31 King St. West MANCHESTER 3 | 34 Great North Road NEWCASTLE-ON-TYNE 2 | 41 St. Vincent Place GLASGOW C1 |



**Little Barford B Power Station**
"Outdoor installation of 2 boilers."





**Aberthaw Power Station**
"Panel wall construction on site for one of 6 boilers."

**Drakelow Power Station**
"Drum lift for one of 3 boilers."

# BOILERS UNDER CONSTRUCTION

*by*

# FOSTER WHEELER

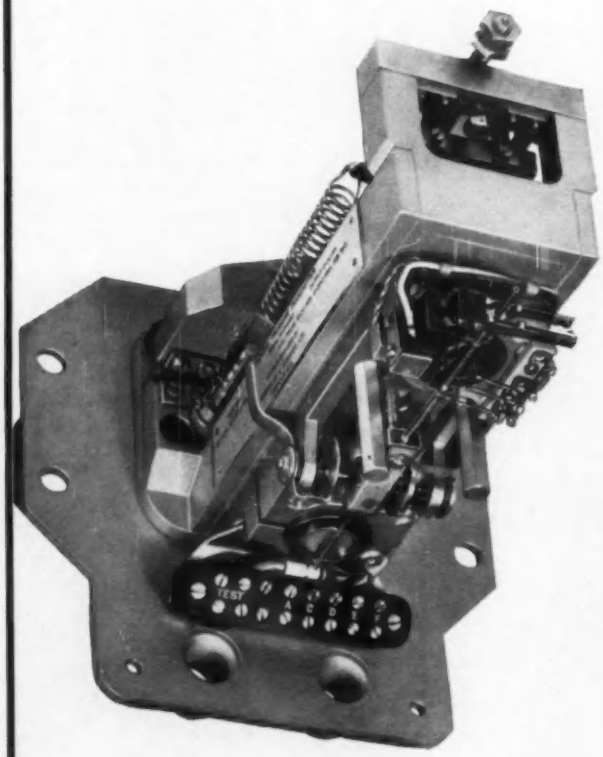
**For the Central Electricity Generating Board**

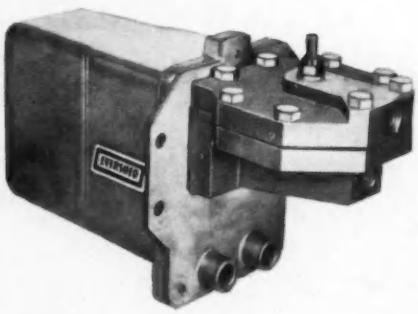
**Northfleet Power Station**
"Tube wall assembly for one of 6 boilers."

**FOSTER WHEELER LIMITED**

FOSTER WHEELER HOUSE, 3 IXWORTH PLACE, LONDON S.W.3.

# Control flow with confidence by using EVERSHED FLOW TRANSMITTER





The ER.125 is not only designed for the accurate measurement and control of flow or differential pressures, but also to give reliable service under the most exacting conditions. Suitable for oil, viscous or corrosive fluids, water, steam or gases,

the ER.125 can be supplied with:

Ranges 0–5″ to 0–50″ W.G.
0–20″ to 0–200″ W.G.

Maximum working pressures 1,000 p.s.i.

"Fluon" coated glass cloth or reinforced "Neoprene" diaphragms.

Output current proportional to flow or differential pressures:
0–15 milliamps D.C.
0–30 milliamps D.C.

This transmitter is intrinsically safe for petroleum vapours and hydrogen.

*Publication ES/SS.1 sent on request.*

**EVERSHED**

**serves industry**

INSTRUMENTATION AND CONTROLS DIVISION
EVERSHED & VIGNOLES LTD · ACTON LANE WORKS · CHISWICK · W.4
*Telephone:* Chiswick 3670 *Telegrams:* Megger, London, Telex

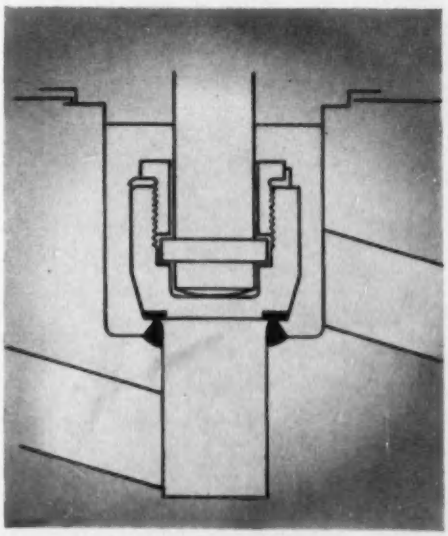
7/97

# REDUCE MAINTENANCE COSTS BY INSTALLING VALVES FITTED WITH

# "HARD FACED"

## SEATS AND VALVE HEADS

**These Valves are giving long trouble-free service in land, marine and naval installations**



## "STELLITE" HARD FACING POSITIVELY PREVENTS LEAKAGE

**The seat, shown opposite, is an integral welded "HARD FACE" deposit, accurately machined. The valve head is similarly deposited.**

### THE RESULTANT SEAL

(a) Offers utmost dependability to meet severe conditions,
(b) is tough and hard,
(c) is erosion and corrosion resistant, and
(d) eliminates seat replacements.

**"HARD FACED" VALVES can be supplied ranging from $\frac{1}{4}$ in. bore, for pressures from 600 lb./sq. in. upwards, and temperatures up to 850 deg. F.**

# WEIR VALVES LTD.

QUEENSLIE INDUSTRIAL ESTATE GLASGOW, E.3
Telephone: SHETTLESTON 4201/4

Suppliers of speciality valves to United Kingdom Atomic Energy Authority

# Tri-Mor Plastics & Castables

## MAKE INSTALLATION EASIER, QUICKER AND CHEAPER

Front and side walls of a Queen Mary boiler in Tri-Mor High Temperature Mouldable, with MR 60 anchors. Burner quarls in Tri-Mor High Temperature Castable.

### TRI-MOR GRADES

**TRI-MOR** *Standard Castable*

A medium texture refractory having negligible shrinkage up to 1,350°C. Suitable for casting special shapes or for monolithic structures. Limiting service temperature 1,350°C.

**TRI-MOR** *High Strength Castable*

A similar refractory to Tri-Mor Standard Castable, but specially developed to have very high mechanical strength over the lower temperature range. Maximum service temperature 1,250°C.

**TRI-MOR** *High Temperature Castable*

Suitable for face temperatures up to 1,600°C; has an extremely high resistance to thermal shock; used for cast in situ monolithic structures and for pre-cast refractory shapes; can be applied with a cement gun.

**TRI-MOR** *High Temperature Mouldable*

A plastic refractory for use up to 1,650°C: low shrinkage and a high resistance to spalling. Supplied mixed to the correct consistency for installation.

**TRI-MOR** *Dense "Guncrete"*

A hydraulic setting refractory with a maximum service temperature of 1,300°C. It has a high resistance to abrasion. Designed for application by cement gun, but can be trowelled.

**TRI-MOR** *Insulating Castable*

An insulating castable for maximum service temperatures of 1,200°C; low thermal conductivity is its main feature.

**TRI-MOR** *Insulating "Guncrete"*

Similar to Tri-Mor Insulating Castable but for application by cement gun.

*Full details of each grade are available on request.*

MORGAN Refractories Ltd

*For further information please write to:* MORGAN REFRACTORIES LTD. NESTON, WIRRAL, CHESHIRE. TEL: NESTON 1406

NE 138

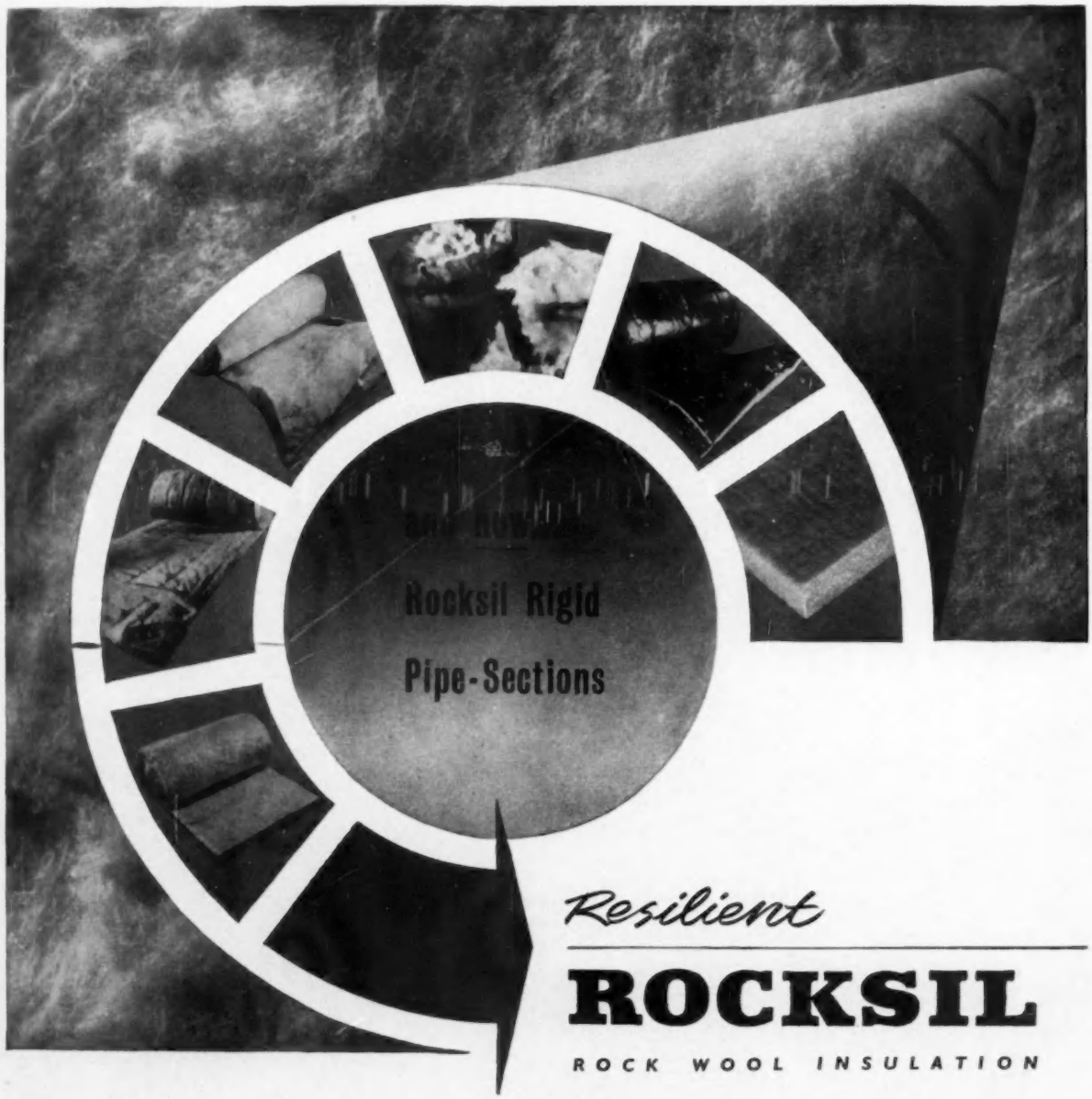
**Just another reminder**

The SUPERHEATER Company Ltd
the Authority on Superheated Steam

97 TOTTENHAM COURT ROAD LONDON W.1
Works: Trafford Park Manchester 17

Telephone: LANgham 0431 (8 lines).

Broadway c/24

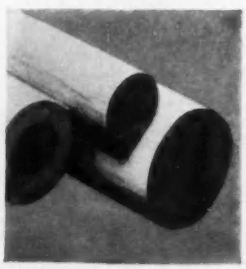



*Resilient*

# ROCKSIL

ROCK WOOL INSULATION

That's the latest addition to this highly successful range of rock wool insulating materials. Great strength, accuracy of manufacture, and superior finish, along with all the usual properties of Rocksil, make these rigid sections an efficient means of insulation up to 600° F. For hot water lines, steam lines, and steam traced oil lines, Rocksil rigid pipe sections provide well-fitting and inexpensive insulation that is particularly resistant to corrosion.



**Canvas or scrim wrapped, with or without bands. In 3 ft. lengths, thicknesses by ½" steps from ½" to 2". Uniform density 10 lb/cu. ft.**

*Full information available from the manufacturers:*

**THE CAPE ASBESTOS CO LTD** 114 & 116 Park Street, London W.1. Telephone: GROsvenor 6022

*and at: Glasgow; Eagle Buildings, 217 Bothwell St., Glasgow, C.2. Tel: Central 2175*
*Birmingham: 11 Waterloo St., Birmingham 2. Tel: Midland 6565-6-7*
*Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3. Tel: Deansgate 6016-7-8*
*Newcastle: 19 & 20 Exchange Buildings, Newcastle-upon-Tyne. Tel: Newcastle 20488*

TA674

# *"Let's tackle this problem once and for all,"*

## SAID THE CHAIRMAN

" We're agreed ' clean air ' is here to stay but is this the best way to achieve it ? "

*" It's not the cheapest—in terms of initial cost at any rate."*

" But can we afford to settle for anything cheaper ? "

*" Afford to ? I don't quite follow you."*

" I am thinking in terms of power costs, running costs and so on.
You know how maintenance and repairs can run away with the money."

*" It still seems a high price to pay."*

" Not for long years of trouble-free running.
I suggest, gentlemen, that we tackle our ' clean air ' problem once and for all
with electric-precipitation—by Simon-Carves of course."

**HIGH EFFICIENCY ELECTRO-PRECIPITATION BY**

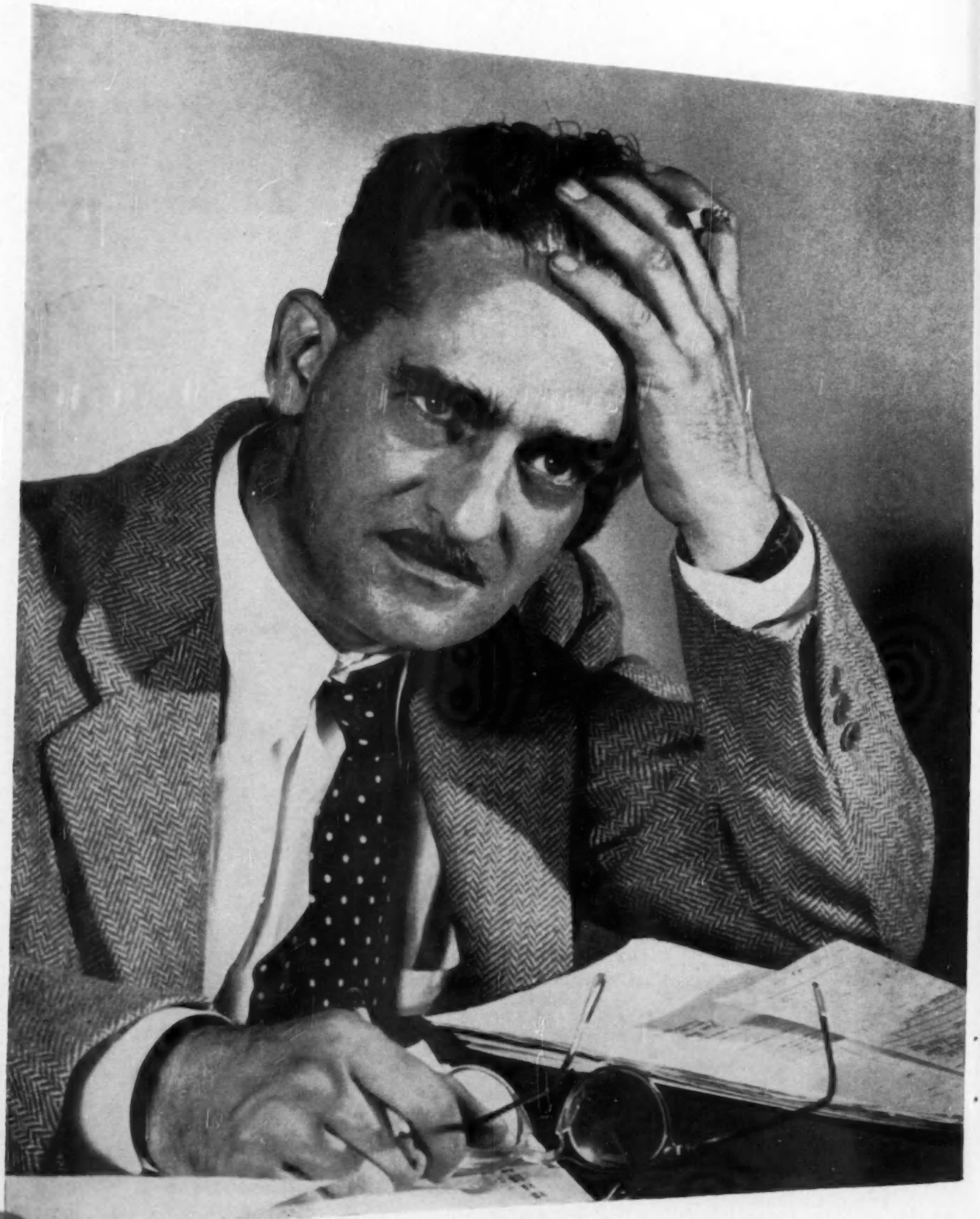
# *Simon-Carves Ltd*

SIMON ENGINEERING GROUP

STOCKPORT, ENGLAND

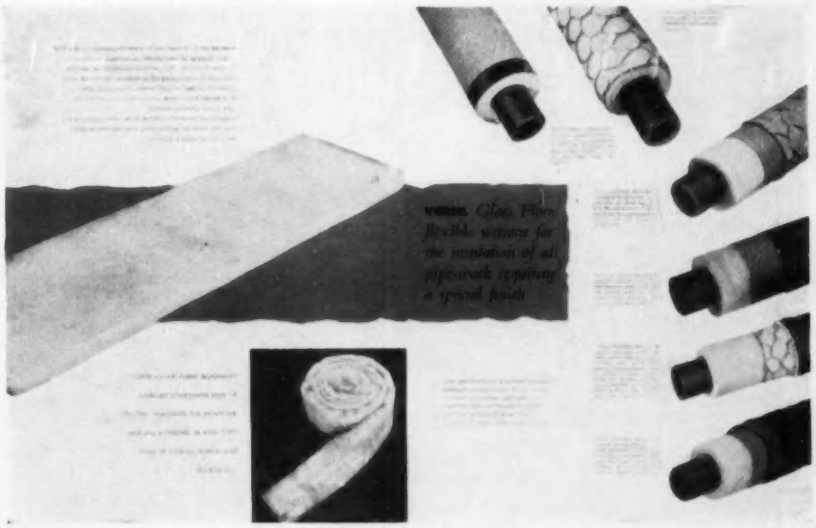
OVERSEAS COMPANIES | *Simon-Carves (Africa) (Pty) Ltd: Johannesburg* *Simon-Carves (Australia) Pty Ltd: Botany, N.S.W.*

SC 201



# "O.K.– Let's call it a day"

*" I've done my best—I can't do more. I've saved this firm hundreds of pounds by fuel economies in the last few years. I've never missed a trick. But still fuel costs keep going up and spoiling the picture. I've had enough. It's more than flesh and blood can stand. I'm through . . ."*

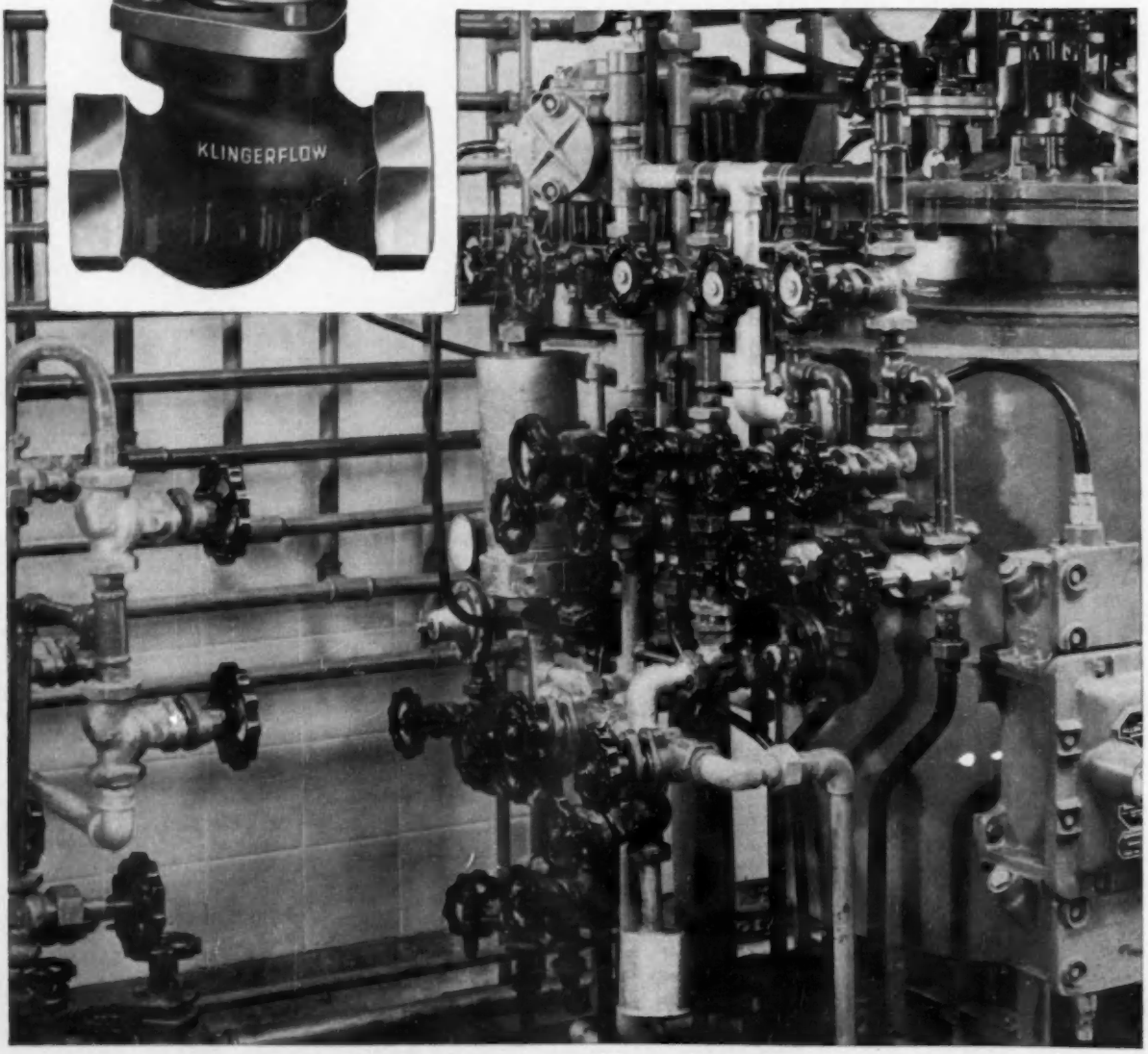


*A "spread" from a Versil publication— THERMAL INSULATION*

Just a minute, Sir. Before you leave us for good—isn't there one trick you're missing ? You haven't put in VERSIL Glass Fibre insulation yet, have you ? That means you don't yet know what really efficient insulation, complete insulation, can do for you. May we show you ? It'll brighten things up for you considerably. You might even recover the will to live ! Just write to VERSIL Ltd., Rayner Mills, Liversedge, Yorkshire. Telephone Cleckheaton 640.

**What You Need Is** *Versil* **THE GLASS FIBRE INSULATION**

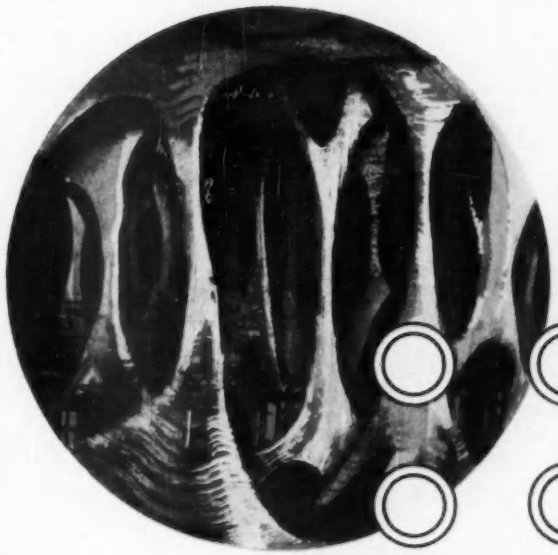
# *Klinger* PISTON TYPE VALVES



THE photograph shows a small part of the Fermentation plant at the Beecham Research Laboratories at Betchworth, where microbial substances are produced. All the valves visible in the picture and throughout the plant are Klinger Piston Valves. Klinger Sleeve-packed Cocks are also installed. The fluids controlled by valves include steam, hot and cold water, brine and compressed air.

**RICHARD KLINGER LIMITED, KLINGERIT WORKS, SIDCUP, KENT. Telephone: Foots Cray 7777**

G37/58/V



BY APPOINTMENT TO
HER MAJESTY THE QUEEN
SPECIALISTS IN ORGANIC
WATER TREATMENT

# WATER: WORKER OF WONDERS

Structures of remarkable beauty and interest are slowly created in nature by the minute quantities of lime and minerals deposited by water.

"Fresh" water is active—a builder and a destroyer particularly when used for heating or cooling. In boilers, internal combustion engines etc., hard water brings scale, soft water corrosion. Even $\frac{1}{8}$" of scale can cause fuel costs to rise by 18%—corrosion may mean costly replacements—both can be dangerous.

It is essential that the water treatment methods used in preventing scale and corrosion are prescribed by a reputable Company.

Houseman & Thompson Ltd., has over 80 years experience in water treatment service to Industry, overcoming individual problems in every part of the world. Constant checks are made on water from plants using our products. Engineers are based in every port and industrial centre in Great Britain.

*We would be pleased to supply comprehensive information on water treatment, descaling and degreasing by the Houseman & Thompson Ltd., Service.*

INTERNATIONAL H&T SYMBOL OF SERVICE

**HOUSEMAN AND THOMPSON LIMITED**
**D. M. HOUSE - JESMOND ROAD - NEWCASTLE - UPON - TYNE**

*Technically represented in over 60 overseas centres*

WICKSTEED

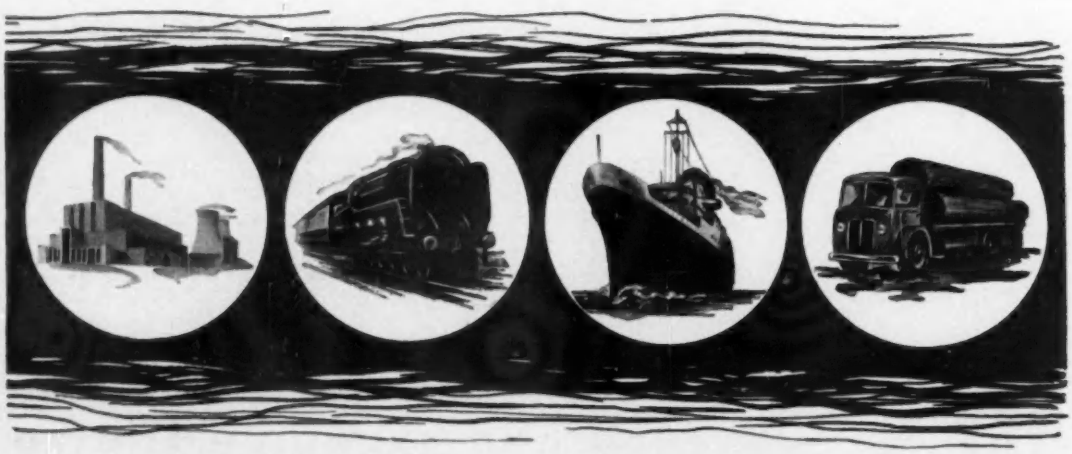
REGD TRADE MARK

# TUBE EXPANDERS

## FOR ALL PURPOSES

*As supplied to the Admiralty, Central Electricity Authority, Railways, Oil Refineries, leading Boiler Makers and Industrial users.*

**LEADING TUBE EXPANDER MANUFACTURERS FOR OVER 70 YEARS**



**CHARLES WICKSTEED & CO. (1920) LTD. KETTERING. Tel: Kettering 3113**

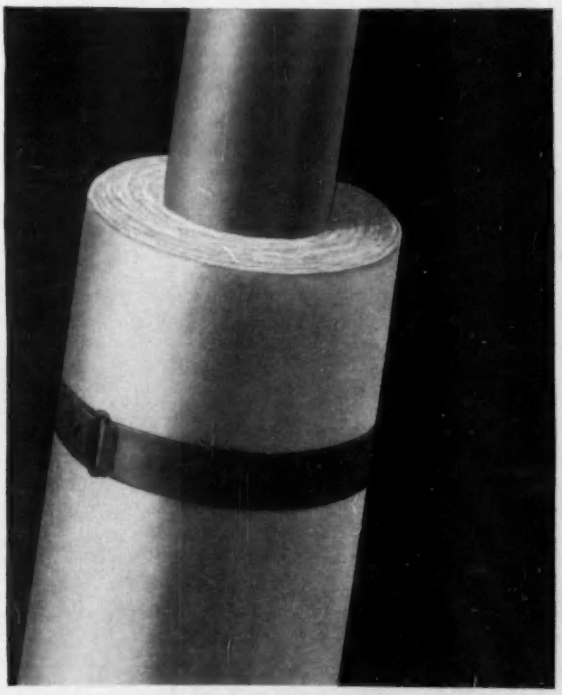
# "I WAS A WASTER!"

## —*Steam Pipe confesses*

"I am a four-inch bore pipe. I work in a factory. It is my job to carry steam at 450°F. from generator to the plant. But I was a waster, a fuel waster, a *very* fuellish waster indeed!

I used to work naked as the day I was drawn. Of course I wasted heat—and therefore fuel—but who cared? Then one day, a bright spark from Fibreglass told the Manager that I was wasting nearly one ton of coal a year through each foot of my length.

I felt naked—and ashamed. Quickly they had me wrapped in a Fibreglass rigid section 1¾" thick. Now, this is saving 18½ cwts. of each ton I used to waste. My conscience is clear; but if pride is a sin, I'd better look out. Because I *am* proud of my slim figure, my neat nesting and my light-weight on hangers."



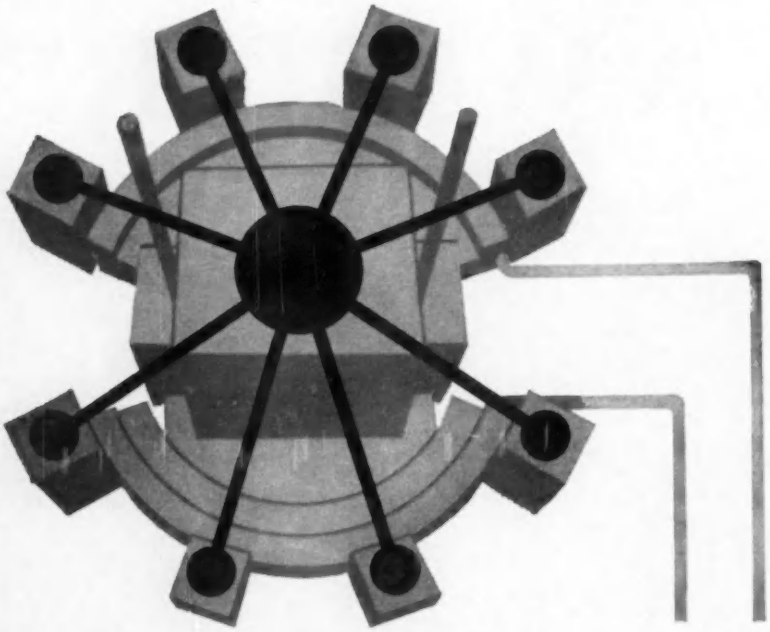
FIBREGLASS
TRADE MARK

## "RIGID SECTIONS WERE MY SALVATION!"

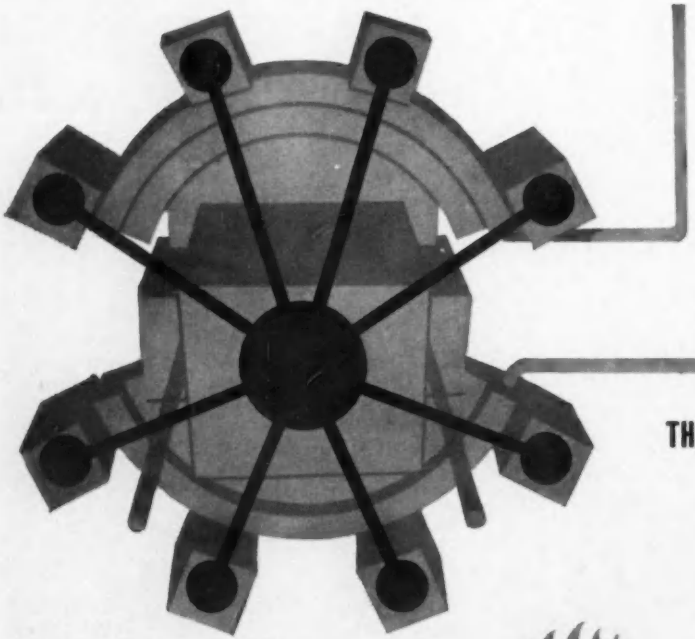
*—STEAM PIPE TESTIFIES*

*For the whole story, please write to:*

FIBREGLASS LIMITED, ST. HELENS, LANCASHIRE · ST. HELENS 4224



# BERKELEY—a challenge to insulation



The heat developed by the twin reactors of the new Berkeley atomic power station poses problems of thermal insulation which will require new techniques in their solution. Confining and controlling such intense yet precious thermal energy constitutes a challenge—a test worthy of the knowledge and skill acquired in 65 years' experience of thermal insulation manufacture by The Cape Asbestos Company, to whom the contract has been entrusted.

## THE CAPE ASBESTOS COMPANY LIMITED

*Manufacturers of:*

**CAPOSITE**
Moulded Amosite Asbestos Insulation

**ROCKSIL**
Rock Wool Insulation

**PLUTO**
Asbestos Textiles

At the Berkeley Nuclear Power Station of the Central Electricity Generating Board, the contract for supplying and installing thermal insulation for the TWO REACTOR PRESSURE VESSELS, 16 HEAT EXCHANGERS, THE $CO_2$ DUCTING AND MAIN STEAM PIPES has been awarded by the main contractors AEI- John Thompson Nuclear Energy Co. Ltd., to The Cape Asbestos Company Limited.

CAPE

**ASBESTOLUX** asbestos insulation board, **MARINITE** asbestos sheet and **CAPASCO** moulded brake linings and clutch facings are also manufactured by the Cape Asbestos Group of Companies.

**THE CAPE ASBESTOS COMPANY LIMITED**

114 & 116 PARK STREET, LONDON, W.1. TELEPHONE: GROSVENOR 6022

# Whatever your tube maintenance problems AIRETOOL equipment will solve them FASTER... EASIER... AT LESS COST

•

*Write, telegraph or telephone for complete information*

**ENGLAND SALES OFFICE**
8 Woodland Way
Morden, Surrey, England
Telephone: Liberty 7039
G. B. Herbert
Sales Representative

•

**EUROPEAN FACTORY AND WAREHOUSE**
18 Industriweg
Vlaardingen, The Netherlands
Telephone: Vlaardingen 5254

•

**CANADIAN PLANT**
37 Spalding Drive
Brantford, Ontario

**AIRETOOL** *automatic*

## TUBE EXPANSION CONTROLS

**roll tubes faster... with uniform accuracy!**

**In Airetool automatic tube expansion controls,** precise electrical "feel" replaces inexact manual "feel" and human error! This assures uniformly accurate tube rolling at a high rate of production . . . even with semi-skilled crews. For example, a coppersmithing company rolled-in 850 four inch OD, 13 gage copper tubes in 5 hours — one every 20 seconds — using Airetool's automatic tube expansion system.

**Control No. 113-15** rolls tube sizes ½" to 2½". Supplied with any combination of 3 sizes of electric motors. Produces tight, strong tube joints, stops distortion or breakage of tube sheet ligaments.

**Control No. 103-5** designed for tube sizes ¼" to ⅞". 3 motor sizes available. Maintains precise expansion dimension desired every time. Unaffected by normal tube sheet hole size or tube variations.

ELECTRICAL SYSTEM

PNEUMATIC SYSTEM

**Airetrol Model 1000** combines complete control system and powerful pneumatic motor in a single tool. Finger-tip expansion adjustment accurate within .001". For ¼" to 1½" tubes.

***A pioneer in the tube expansion field, Airetool has conducted much basic research in the art of tube rolling. The results of this research are available to you, without obligation, through experienced Airetool representatives. Or, write for Airetool's Tube Expansion Control Fact Sheets.***

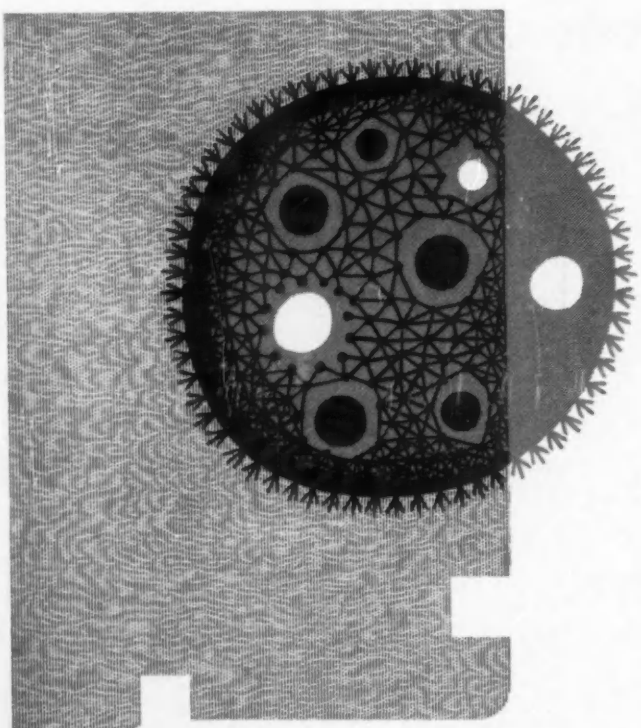
**BRANCH OFFICES:** New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge.

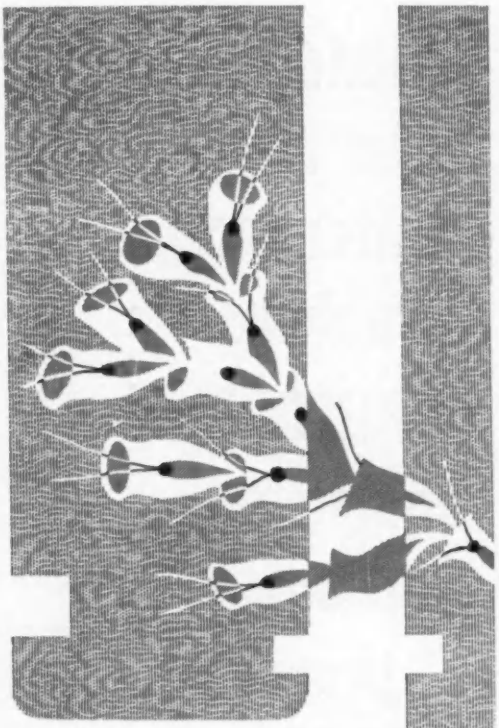
**REPRESENTATIVES** in principal cities of U.S.A., Canada, Mexico, South America, England, Puerto Rico, Italy, Japan, Hawaii.

**EUROPEAN PLANT:** Vlaardingen, The Netherlands.

**CANADIAN PLANT:** 37 Spalding Drive, Brantford, Ontario.

**AIRETOOL**
MANUFACTURING COMPANY
SPRINGFIELD, OHIO



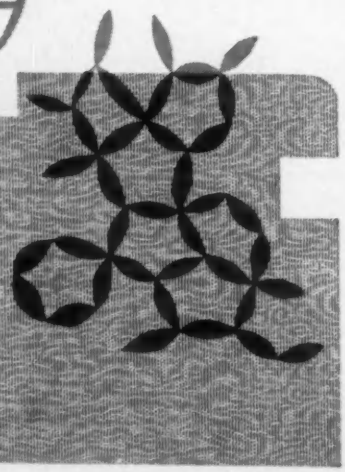


# Get these out of your system!

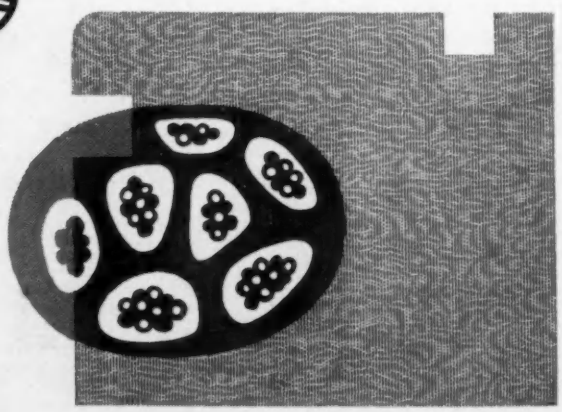
These are some of the slime-forming organisms which cause loss of efficiency and blockages in industrial cooling water systems by fouling heat-transfer surfaces, filters, pipes, storage basins and cooling towers. Organic growths can be controlled by chlorination, a simple method which increases efficiency and reduces to a minimum the interruption of plant operation. For advice on the application and handling of liquid chlorine and hypochlorites, consult:

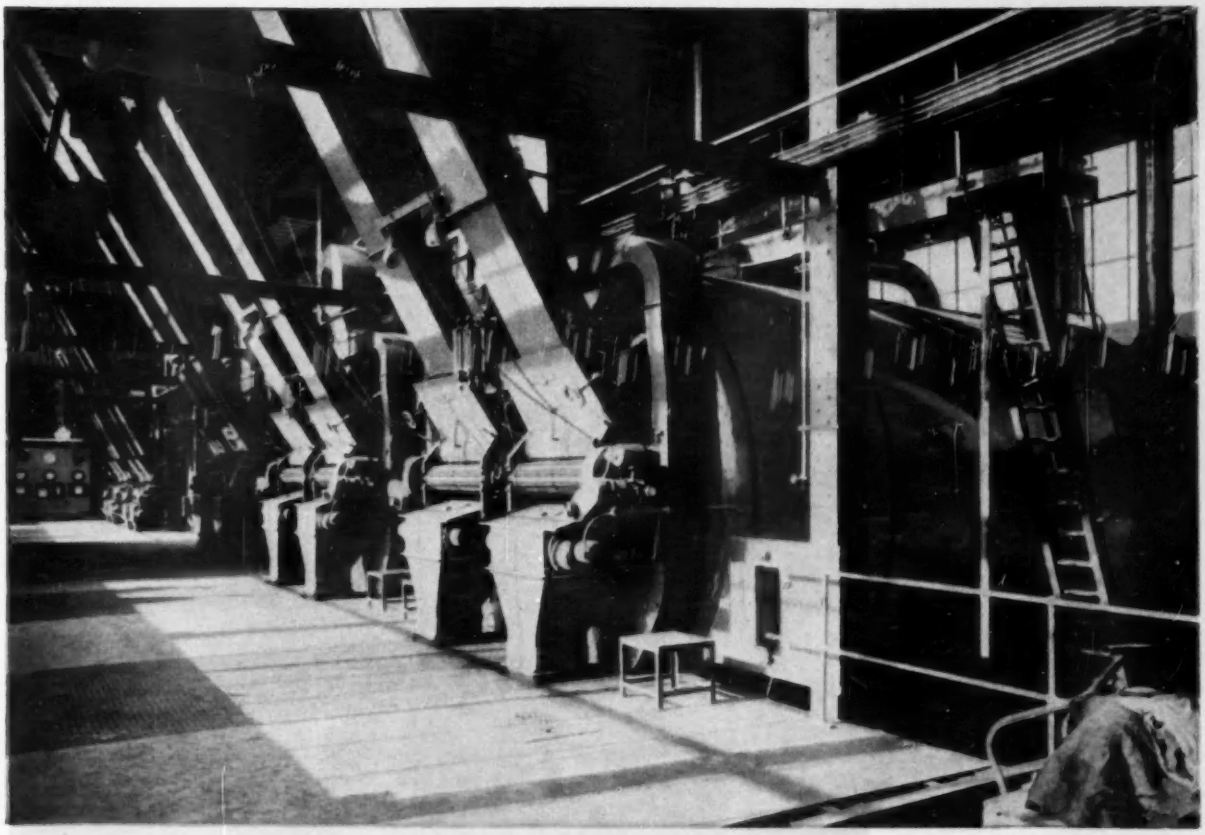
**IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1**

CIL 67

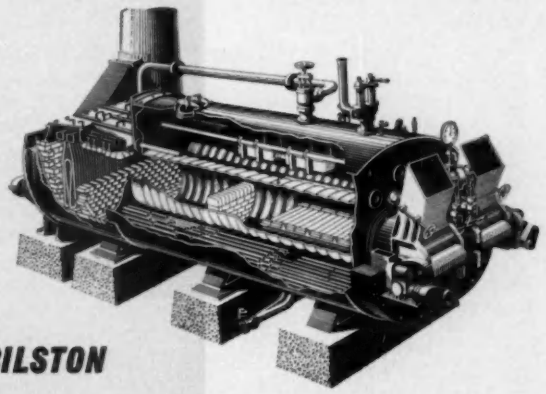


ICI





# JOHN THOMPSON SUPER ECONOMIC BOILERS



## at

## JOSEPH SANKEY & SONS LTD · BILSTON

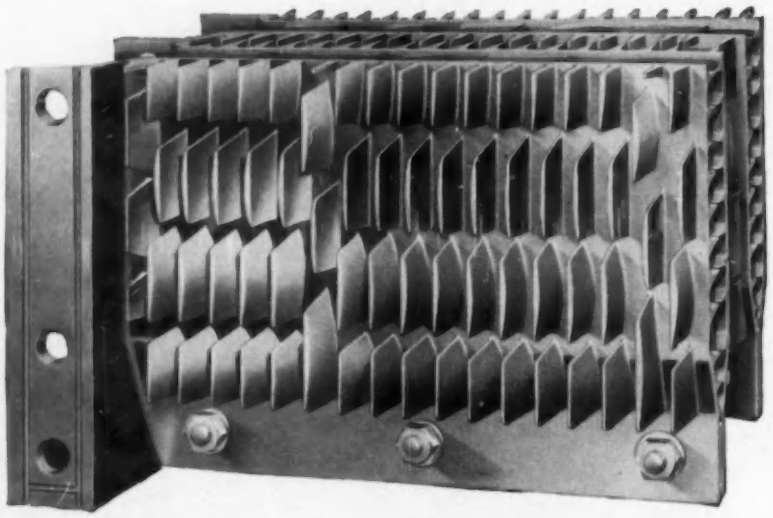
The new boiler plant at Joseph Sankey and Sons Ltd., Bilston, has five John Thompson Super Economic boilers, stoker fired. Three of the boilers each have an evaporation of 15,000 lb/hour and the remaining two 10,000 lb/hour, working pressure 120 lb/sq in The larger boilers are equipped with superheaters. Mechanically operated ash extractors are fitted to the Thompson-Triumph stoker, the ash then passing to the John Thompson submerged-belt ash conveyor. Equipment manufactured and erected by members of the John Thompson Group of Companies included boilers, stokers, chimneys, feed tanks, coal and ash handling plant, pipework, walkways, ladders and windows, instruments and panels, ducting, superheaters and feed water treatment plant. Consultants for this installation were Messrs. Powell Duffryn Technical Services Ltd.

JOHN THOMPSON (WOLVERHAMPTON) LIMITED · JOHN THOMPSON GROUP

**JOHN THOMPSON (WOLVERHAMPTON) LTD · WOLVERHAMPTON**

WB1/4.

C



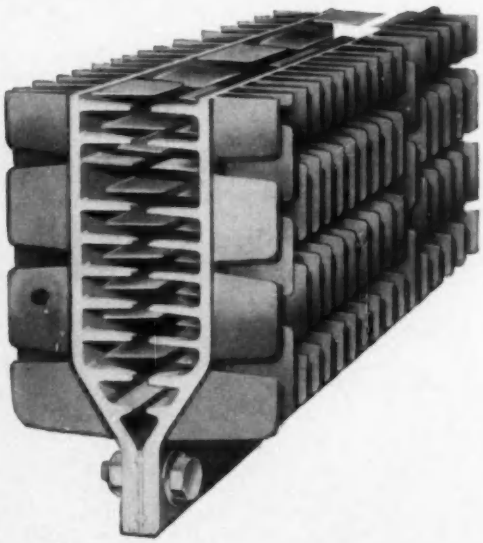
# The KABLITZ-GREEN Cast Iron AIRHEATER

A modern plate-type extended surface air-heater, made of high grade cast iron. The corrosion-resisting properties of cast iron have long been established, and the life of the Kablitz-Green Airheater should be several times that of steel constructions.

The design is such that the slightly curved and slightly staggered fins, with high gas velocities, give high heat transfer rates with minimum air and gas draught losses. The installations are therefore very compact, with the advantage of lower building costs and of shorter ducting.

No driving mechanism is involved and there are no power costs. The design minimises deposition, but where cleaning is necessary it can be done by any conventional system.

Further particulars available on request.



*Manufactured by the makers of the world famous*

## GREEN'S ECONOMISER

**E. GREEN & SON LTD · WAKEFIELD** *Makers of Economisers for more than one hundred years*

GE200

# The most versatile steam trap yet

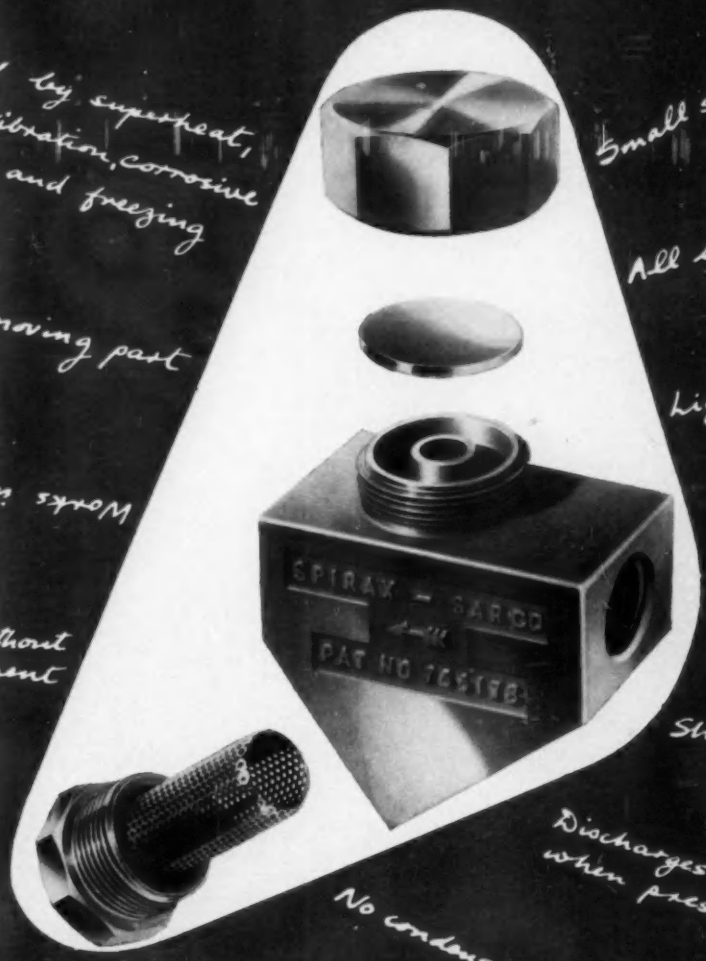
Unaffected by superheat, waterhammer, vibration, corrosive condensate and freezing

Only one moving part

Works in any position

10 – 350 psi without adjustment

Inbuilt stainless steel strainer




Small size

All stainless steel

Light weight

Up to 550°F.

Shuts tight on no load

Discharges condensate when present

No condensate seal or prime

## The Spirax Thermodynamic

Get to know this brilliant new trap NOW

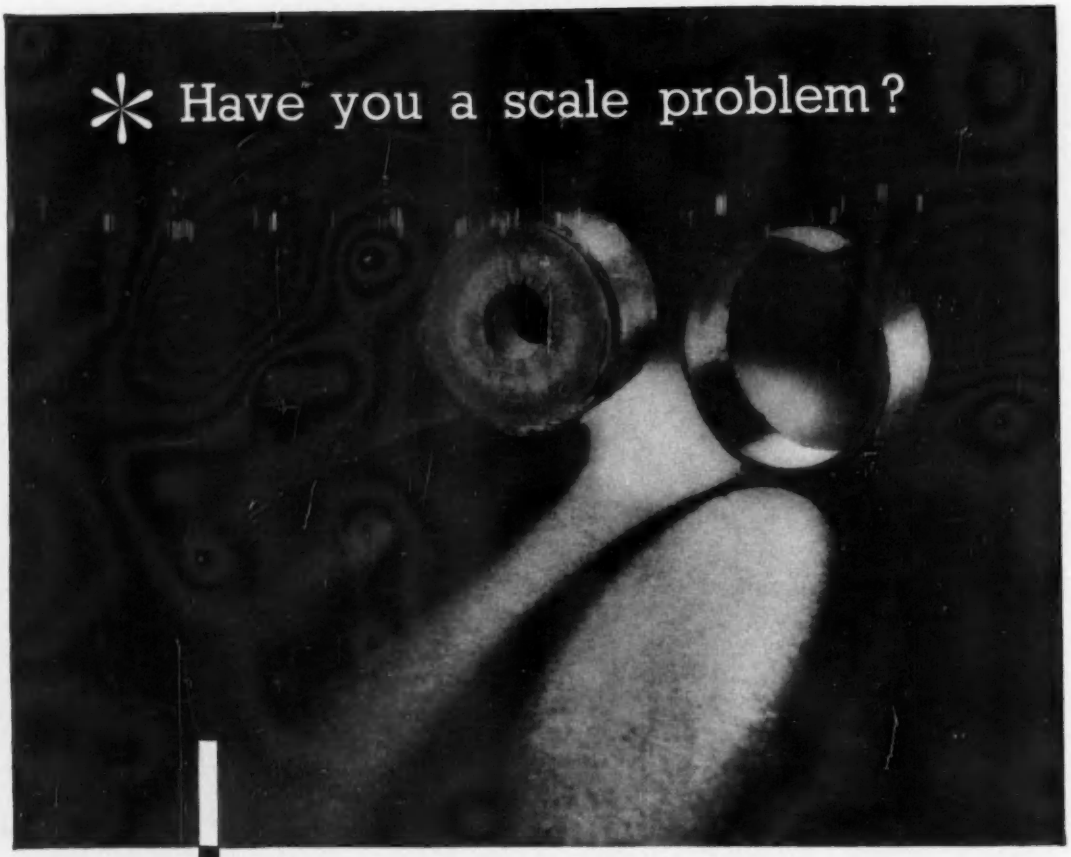
Please post full details of the versatile new Spirax 'TD'

name

address

SPIRAX-SARCO LTD. CHELTENHAM, GLOS PHONE: CHELTENHAM 5178-76 GRAMS: SPIRAX, CHELTENHAM. LONDON OFFICE: 28 VICTORIA STREET, S.W.1 ABBEY 6101-3832

# ✳ Have you a scale problem?



This dramatic illustration, an actual photograph of two pieces of copper piping cut from the same length, shows, on the left, how scale deposit restricts flow and consequent heat transfer and, on the right, how Starit treatment removes the obstructing matter, leaving the surface of the pipe unimpaired.

Scale deposits impose stresses in the metal and seriously reduce the heat transfer efficiency so vital for economical steam raising.
Starit solution effectively removes most types of scale from boilers, feed pipes, heat exchangers, cooling systems and similar apparatus, cleaning those awkward corners beyond manual reach and leaving the metal in a first-class conducting state. The unique formulation of Starit ensures rapid attack on the scale whilst its action on the boiler plate is inhibited.

As there are certain rare cases where the scale is not susceptible to chemical attack, we invite you to send us a sample of scale, so that we can determine whether Starit should be used. We will also supply on request a booklet dealing with the application and limitation of Starit and the methods of using it.

STARIT TRADE MARK

**STARIT** **STARIT LIMITED**
**DARWEN · LANCS**

54

# What are you doing about the Clean Air Act

The Clean Air Act is now fully in force and it provides, inter alia, that it is an offence to emit smoke as dark as or darker than Ringelmann 2 except as permitted in the Dark Smoke (Permitted Periods) Regulations 1958—Statutory Instrument No. 498. Black smoke is a sign of fuel being wasted—usually due to poor stoking. In these days of labour shortage, the most economical answer to the problem is to fit Crosthwaite Gravity Feed Stokers which allow the boilermakers' rating to be maintained without smoke and/or grit emission—and with maximum efficiency. Where maximum flexibility is required, i.e. immediate response to a big demand for steam, fit the Crosthwaite Standard Mechanical Stoker with the Self-cleaning grate. The Clean Air Act need have no terrors for you if you consult Crosthwaite now—without obligation of course.

**CROSTHWAITE**

***FORCED DRAUGHT FURNACES, MECHANICAL STOKERS AND COAL & ASH HANDLING PLANT***

**CROSTHWAITE FURNACES AND SCRIVEN MACHINE TOOLS LTD**

*York Street Ironworks, LEEDS 9* Telephone 3-2411 & 2

*32 Victoria Street, LONDON S.W.1* Telephone ABBey 2966

# REFRACTORY CONCRETE

*THE* ADAPTABLE REFRACTORY MATERIAL

FOR

# HEAT-RESISTANT FLOORS

OF ALL TYPES WHERE RADIANT HEAT OR SPILLAGE OF MOLTEN METAL OR SLAG IS LIKELY TO BE ENCOUNTERED

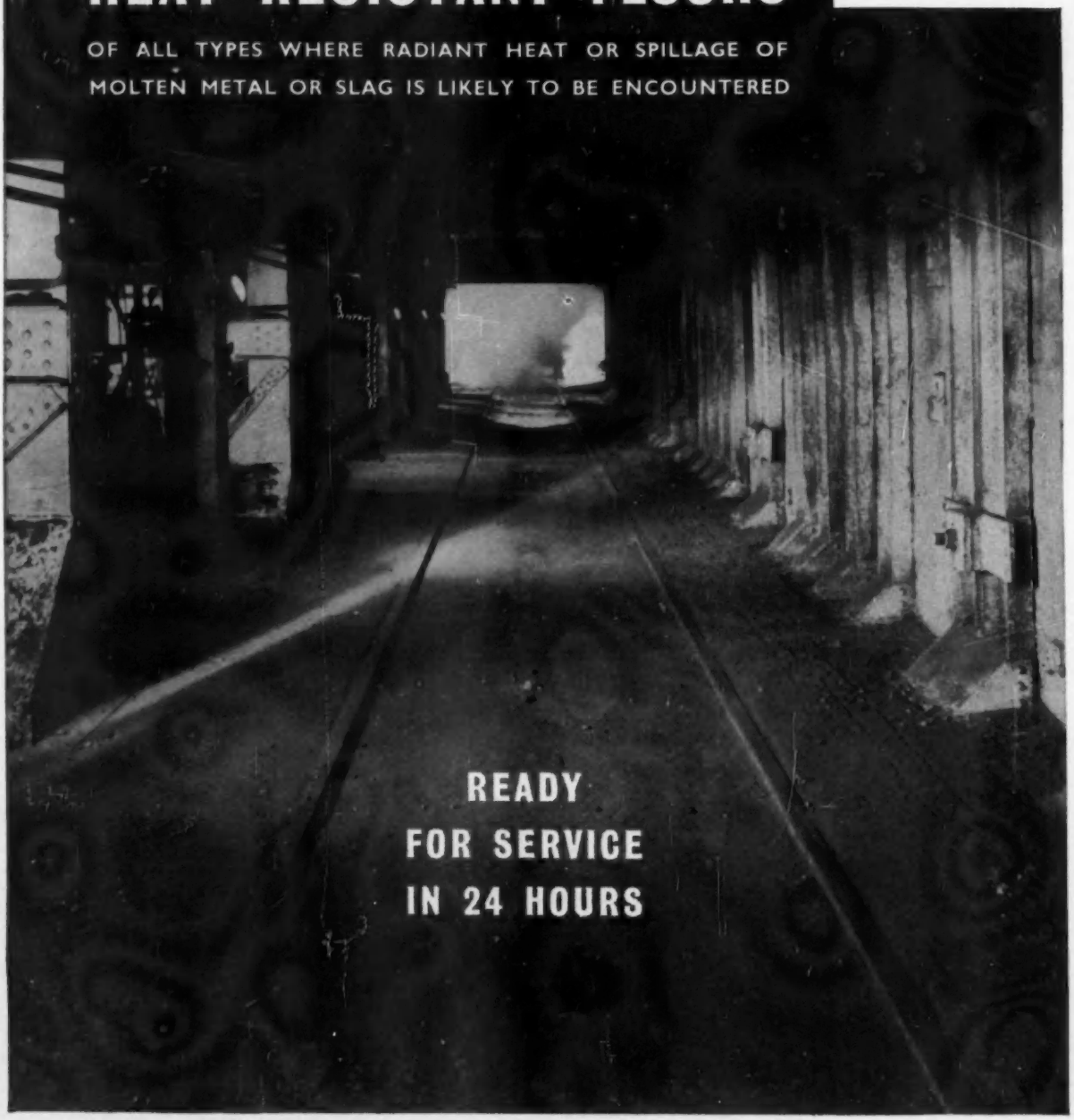
made with

CIMENT FONDU

Regd Trade Mark

ALUMINOUS CEMENT

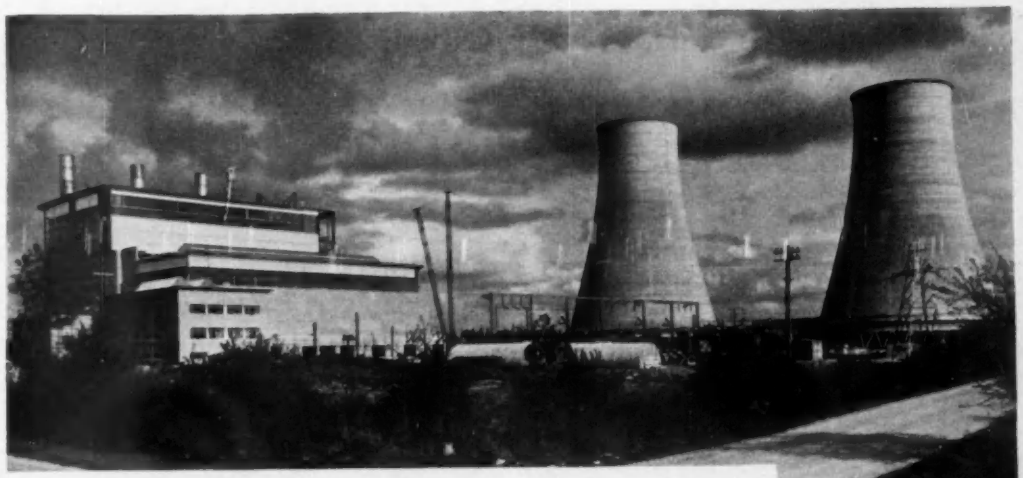
& Crushed Firebrick

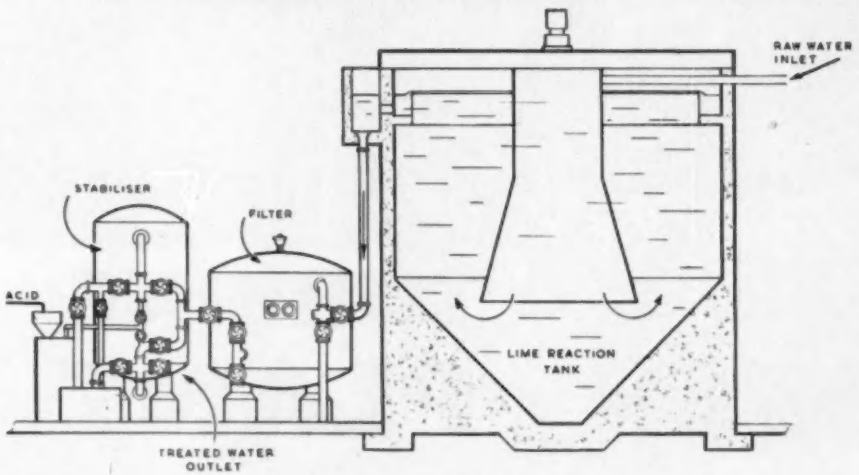



*Write for information to the manufacturers of CIMENT FONDU*

**LAFARGE ALUMINOUS CEMENT CO. LTD.** 73 BROOK STREET, LONDON, W.1 Telephone MAYfair 8546

AP 3/74






# Water Treatment at FERBANE POWER STATION

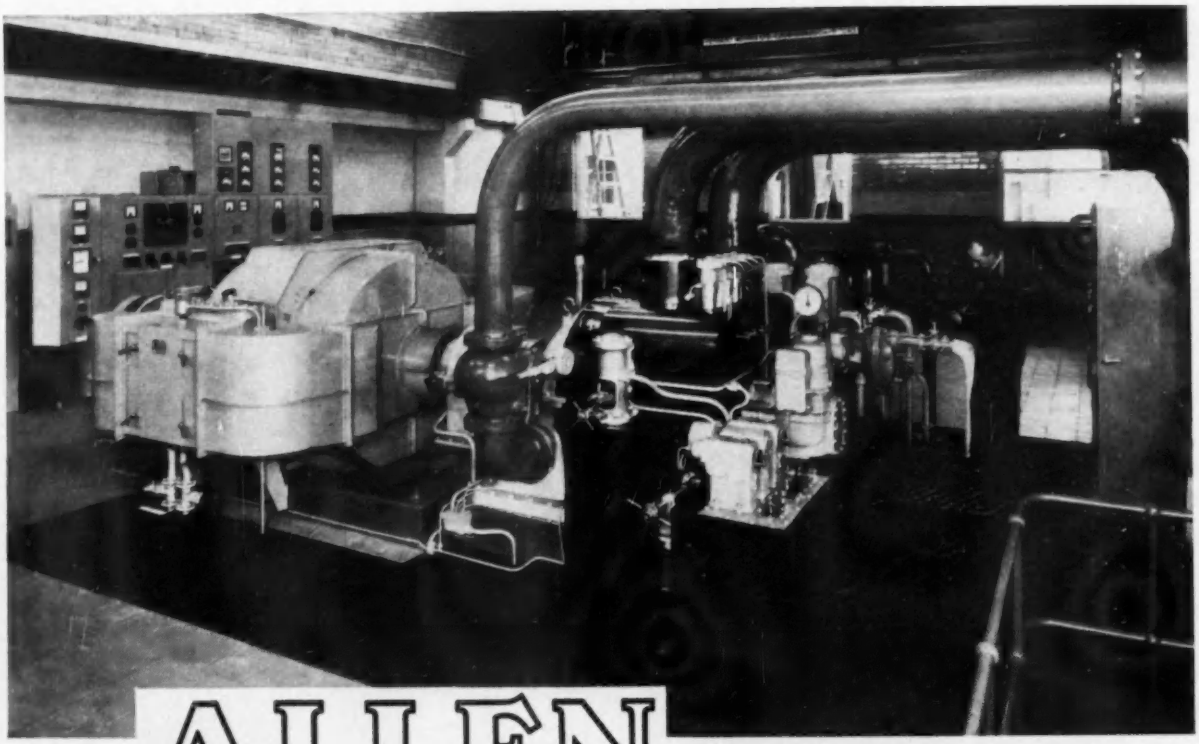
## AUTOMATIC STABILISATION

The lime/stabilisation plant illustrated ensures, automatically, the stability of a water of varying quality softened by lime. Subsequently, the residual hardness of the stabilised water is reduced to zero for evaporator make-up.

UFEL

**UNITED FILTERS & ENGINEERING LTD.**
WATER TREATMENT SPECIALISTS
LONDON S.W.15

TELEPHONE: PUTNEY 4441 TELEGRAMS: UNIFILTERS PUT LONDON



# ALLEN TURBINE POWER PLANT

## for GASWORKS

The turbo-alternator illustrated is typical of 20 Allen sets of varying sizes installed in gasworks during the past ten years. This set is in service at the Bracebridge Works, Lincoln, of the East Midlands Gas Board, and supplies the electric power requirements of the works and is also arranged to run in parallel with the public electricity supply system.

The set comprises an Allen pass-out turbine driving, through Allen-Stoeckicht epicyclic gearing, a 1,000-kW alternator wound for a 6,600-volt, 50-cycle, 3-phase supply, the turbine running at a speed of 8,000 r.p.m. and the alternator at 1,500 r.p.m.

The turbine, which is fitted with inlet-pressure governing and pass-out pressure control, utilizes steam from waste-heat boilers at 110 lb. per sq. in. gauge and 445 deg. Fahr. A pass-out steam supply up to 12,000 lb. per hour at 15 lb. per sq. in. gauge is available for retort steaming and by-product recovery plant.

The condenser, extraction pumps and circulating-water pumps are also of Allen manufacture.

***Specialists in complete industrial power generating plant installations***

**W. H. ALLEN SONS & Co LTD**

**BEDFORD ■ ENGLAND**

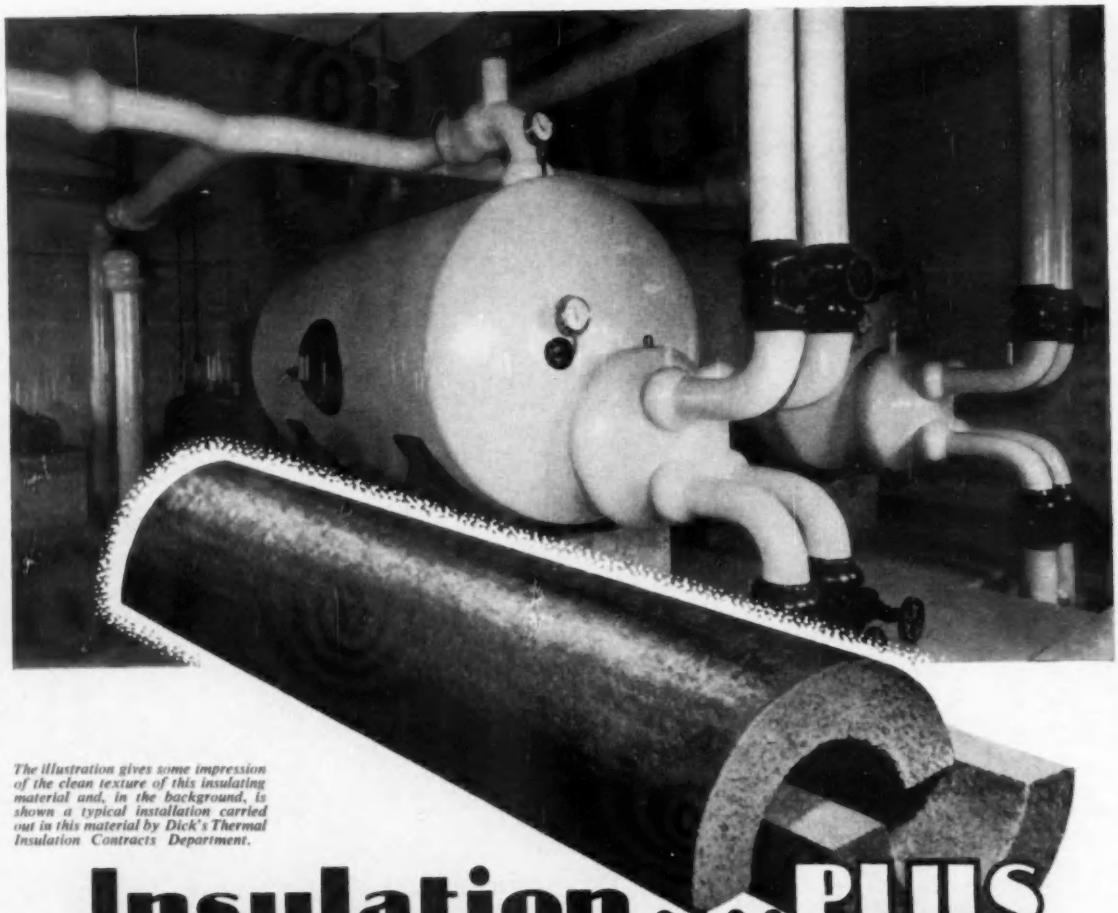
THE pigs, of course, couldn't care less, but the farmer's wife finds it amazing that CRANE giant valves help to keep them well fed. However at the Pfizer Organisation, a large chemical producing factory, there is a department specialising in preparations used in pig feeding. And here these valves are performing vital duties during the early processing stages. The industries which CRANE giant valves serve are varied and numerous . . . and the giant valve is only one among a wide variety of CRANE valves—ranging from ½" to 24"—each with a tradition of reliable, efficient service. CRANE'S reputation for reliability lies in their high standard of design, production and precision testing methods.

**Among the country's largest industries using CRANE giant valves are:—**
*Esso Petroleum Co. Ltd. · Imperial Chemical Industries Ltd. · 'Shell' Refining & Marketing Co. Ltd. · Reed & Smith Ltd. · British Nylon Spinners Ltd. · Pfizer Ltd. · Firestone Tyre & Rubber Co. Ltd.*

# CRANE

**VALVES OF BRONZE, CAST IRON & CAST STEEL**

CRANE LTD., 15-16 RED LION COURT, FLEET STREET, LONDON, E.C.4. Works: IPSWICH
*Branches: Birmingham, Brentford, Bristol, Glasgow, London, Manchester*



*The illustration gives some impression of the clean texture of this insulating material and, in the background, is shown a typical installation carried out in this material by Dick's Thermal Insulation Contracts Department.*

# Insulation ... PLUS
# *Installation .. PLUS*

**Dick's "Antithermic" is a super-efficient thermal insulating material which is strong, light, easy to cut and clean to handle and uniform in structure. It is made from 100% selected amosite asbestos fibre and is supplied in pre-formed pipe sections and slabs of all usual sizes.**

**Dick's Thermal Insulation Contracting Department use "Antithermic" for most of their major insulation contracts; thus applying to industry's fuel economy problems the finest of materials plus the skill and "know-how" of highly trained specialists in the field of thermal insulation.**

# "ANTITHERMIC"

(100% Asbestos)

SLABS and SECTIONS

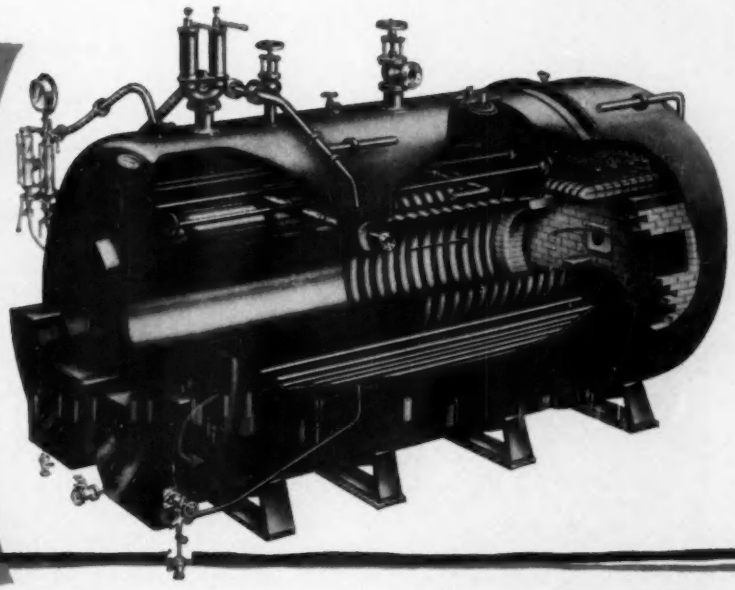
## —DICK'S ASBESTOS & INSULATING CO. LTD.—

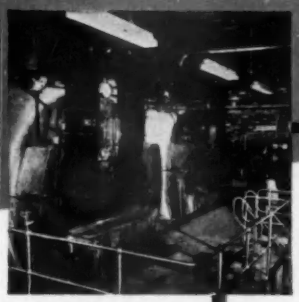
EAGLE WORKS, NORTH WOOLWICH ROAD, SILVERTOWN, LONDON, E.16

TELEPHONE: ALBERT DOCK 4311

DA 2

# SUPER ECONOMIC BOILERS





*An oil-fired Super Economic Boiler installation at Messrs. R. Paterson & Sons Ltd., Camp Coffee Works, Glasgow.*

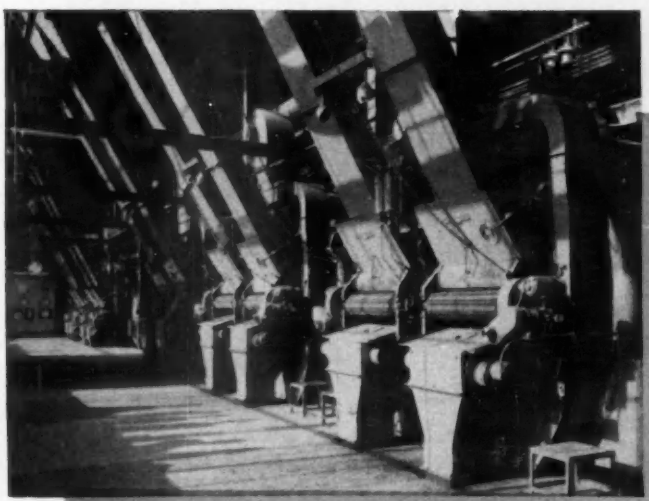
This three-pass boiler, of sturdy welded construction, is the answer to the modern need for efficiency *and* trouble-free service. Large heating surfaces within its comparatively small shell make it a space-saver too. Full range, from 2,000 to 21,000 lb./hr. evaporation, suitable for coal or oil firing. John Thompson (Wilson Boilers) Ltd., will gladly discuss the suitability of their Lancashire, Economic and Super Economic boilers and auxiliaries to meet your requirements.

**JOHN THOMPSON (WILSON BOILERS) LTD**

LILYBANK WORKS · LONDON ROAD · GLASGOW C1

---

# Efficient Burning of *low grade fuel* in Shell Boilers



*John Thompson Triumph Travelling Grate Stokers and handling plant serving five boilers at Joseph Sankey & Sons Ltd., Bilston. Consulting Engineers for this new boiler plant were Messrs. Powell Duffryn Technical Services Ltd.*

## THE THOMPSON TRIUMPH TRAVELLING GRATE STOKER

Steam engineers to-day are faced with the problem of maintaining the required output of steam with fuel which is variable in quality, dear in price and often of the lowest grade. Here is one answer: it is possible to burn even the cheaper low grade fuels efficiently and completely with the Thompson Triumph Stoker.

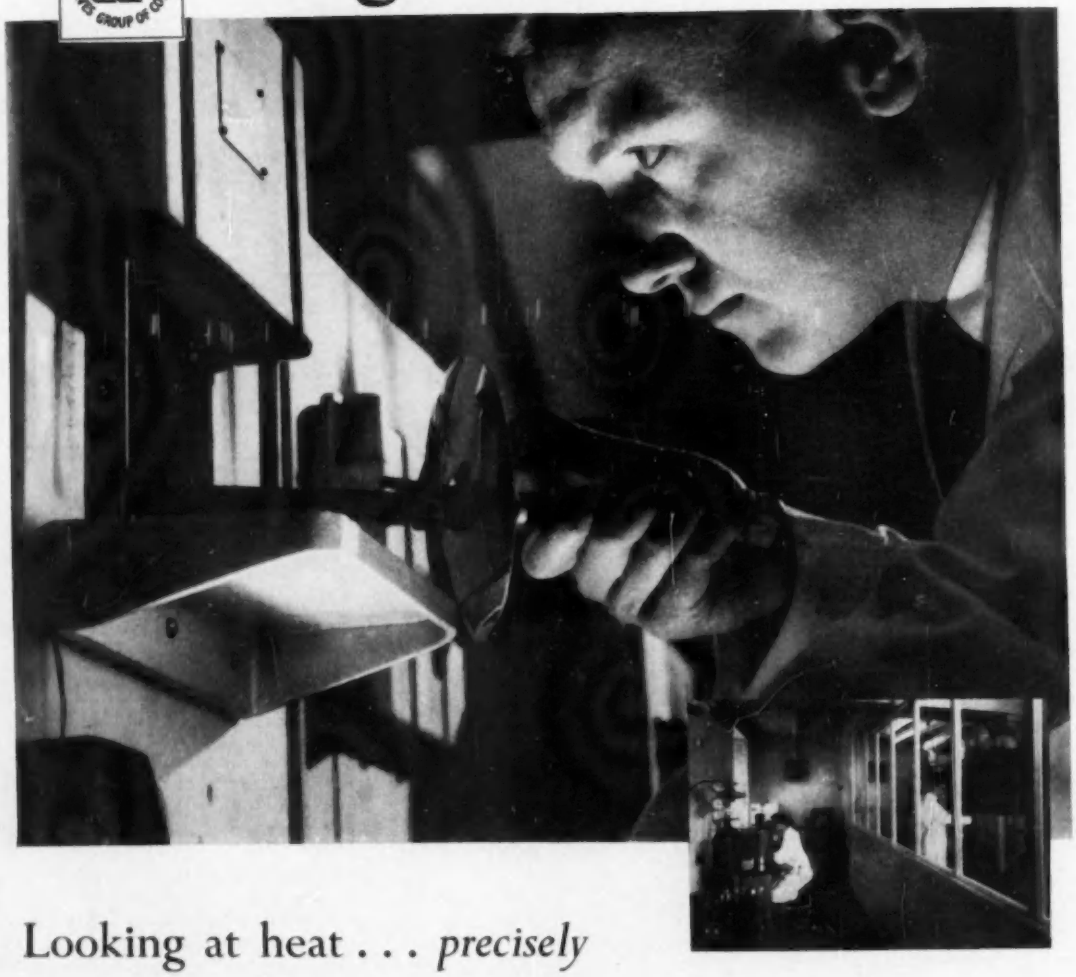
A modified Thompson Triumph Travelling Grate Stoker is available which will successfully burn coke breeze, one of the cheapest fuels.

It will pay you to investigate — write for Brochure "The Best Way to Fire a Shell Boiler".

**JOHN THOMPSON (TRIUMPH STOKER) LIMITED · LEEDS**

TP/1

# Hargreaves *in action!*



## Looking at heat . . . *precisely*

Accurate assessment of quality is essential if Industry is to make the best use of Coal, Coke and Fuel Oil. In the Hargreaves Laboratories, equipped with bomb calorimeters, furnaces and pyrometers, qualified technical staff have fuel samples constantly under test. HARGREAVES sell Heat and their free technical services ensure that the customer gets the utmost value for money.

**HARGREAVES**

**FUEL DISTRIBUTORS**

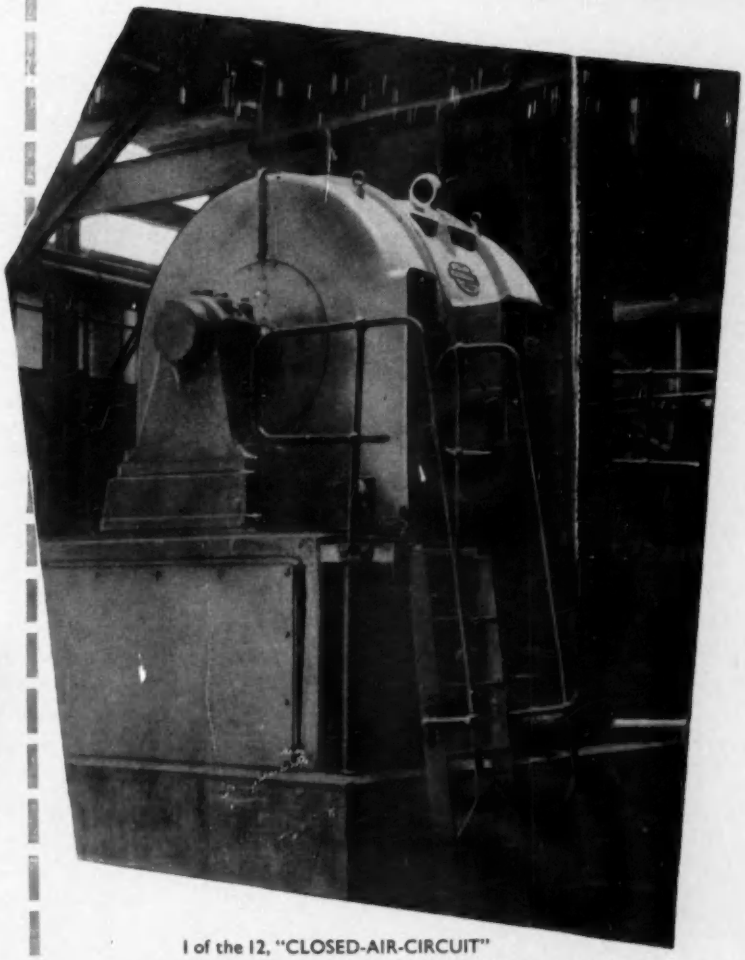
Bowcliffe Hall, Bramham, Boston Spa, Yorks. (*Phone Boston Spa 2081*)

LEEDS • LONDON • HULL • GOOLE • NEWCASTLE • GLASGOW • SUNDERLAND • BRADFORD
HARROGATE • HUDDERSFIELD • SCARBOROUGH • BLACKBURN • MANSFIELD • MIRFIELD • ROTHWELL

rdh 10804d

# You want the Best!

# L.D.C. MOTORS
## at Castle Donington



1 of the 12, "CLOSED-AIR-CIRCUIT" 833/455 h.p. 2-speed, 3.3kV S.C.R. Motors supplied to Babcock and Wilcox Ltd., for driving the Induced Draught Fans at the Castle Donington Power Station.

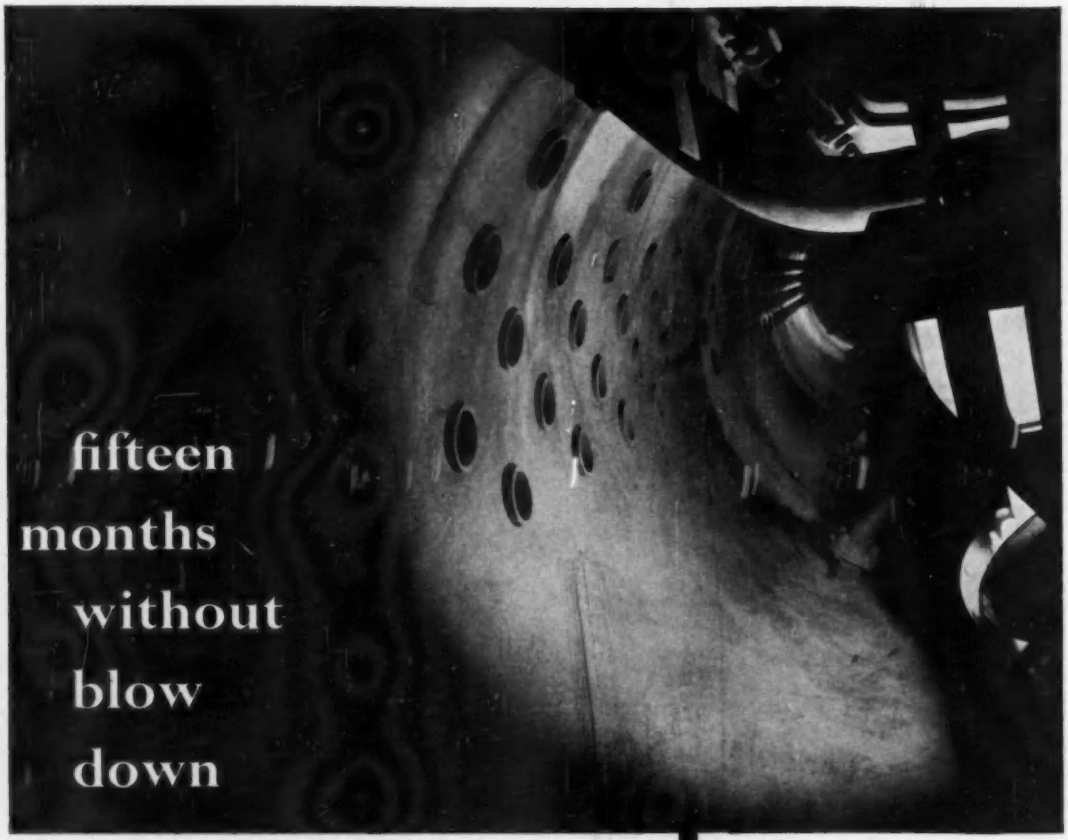
The Symbol of Power and Service for over 50 years

**LANCASHIRE DYNAMO & CRYPTO LTD**

**TRAFFORD PARK, MANCHESTER 17 · ACTON LANE, WILLESDEN, LONDON, N.W.10**

*London & Export Office:* ST. STEPHEN'S HOUSE, VICTORIA EMBANKMENT, WESTMINSTER, LONDON, S.W.1

H.49 A MEMBER OF THE LANCASHIRE DYNAMO GROUP




Zerox (35% hydrazine solution) has been used since July 1954 for treating the boiler feed water in Unit 6 at Dunston Power Station, C.E.G.B. (N.E. Division). On 11th March, 1958, Unit 6 was taken out of commission for overhaul having run continuously since 26th November, 1956. During this period—a total in excess of 15 months' operation—no blow down was required at all. Because of the excellent results obtained with Zerox on Unit 6, Unit 5 boiler was also put on to this form of treatment.

This genuine, untouched photograph shows the interior of the boiler drum after being opened up. The cleanliness of the drum interior after such protracted duty is quite remarkable. The deposit in the drum was only 10 oz., black in colour and composed mainly of magnetite and copper oxide.

From this factual case history, the advantages of Zerox are clearly established. Whiffens, who are the sole manufacturers of Zerox, will be happy to provide any technical information or advice you may require concerning its properties, its economies, its performance and its application. Write for Leaflet No. H/H/2.

REMEMBER POPPY DAY

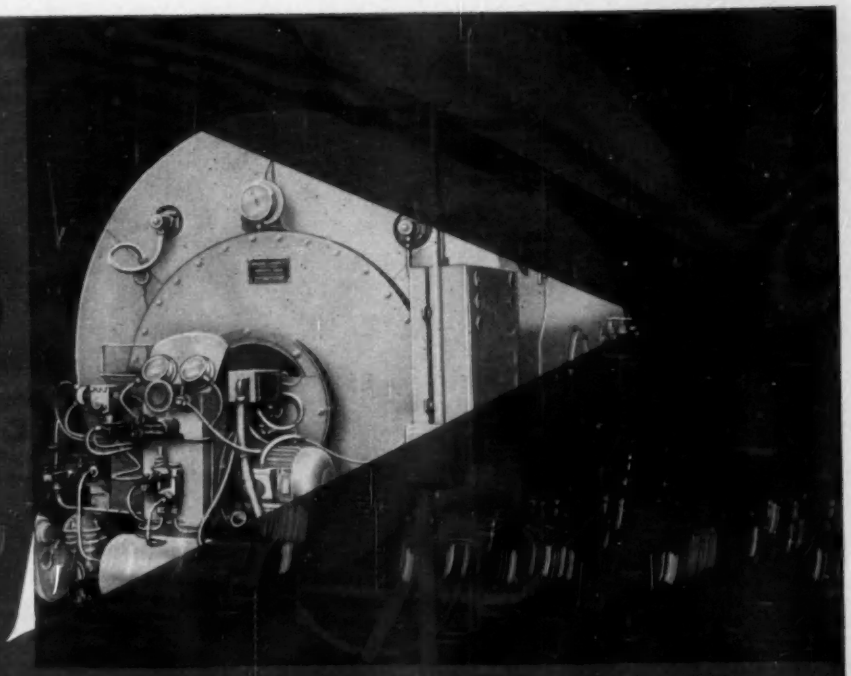
**ZEROX**

**If you are interested in Zerox and the treatment of boiler feed water, you will be interested also in the proceedings of the International Conference on Hydrazine and Water Treatment held at Bournemouth in May 1957. The fully bound book of the Conference is available from the organisers, Whiffens, price one guinea, plus 2s. 6d. postage and packing (in the U.K.)**

**WHIFFENS**
A member of the Fisons Group of Companies
**chemicals for industry**
Whiffen & Sons Ltd., Willows Works, Derby Road, Loughborough, Leicestershire
Telephone: Loughborough 3141
Telegrams: Whiffen, Loughborough. Telex.
Telex. No.: 34548

W28

MORE STEAM



LESS SPACE

*Photograph by courtesy of Messrs. Field, Sons & Co. Ltd.*

with 33⅓% Increased Output

These 3 single pass packaged oil fired boilers were recently installed WITHOUT INTERRUPTION OF SERVICES to replace an outmoded battery of 10 gas fired boilers.

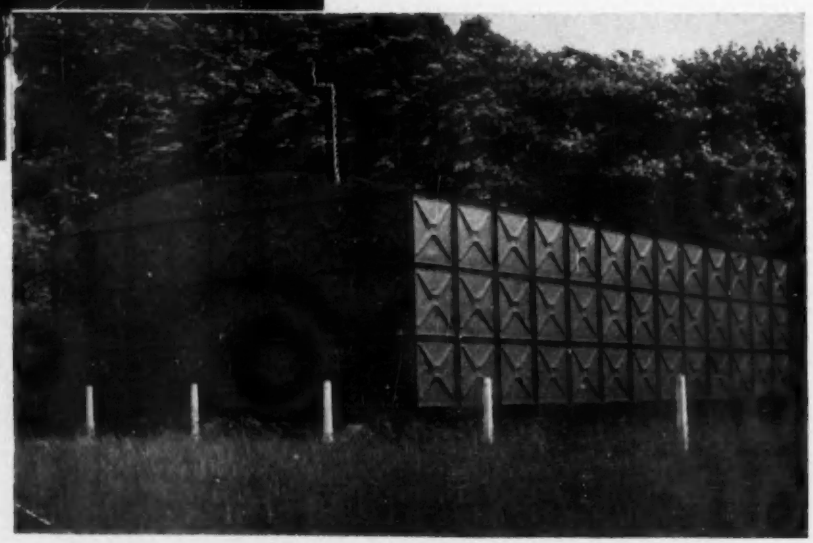
Swirlflo Tubes

SPANNER BOILERS LIMITED

WOKINGHAM ROAD · BRACKNELL · BERKSHIRE · Telephone: Bracknell 1500

*Braithwaite*

# PRESSED STEEL SECTIONAL TANKS



Braithwaite Pressed Steel Tanks with external flanges throughout comply with British Standard 1564 : 1949. The sectional methods of construction enables tanks with an unlimited range of capacities to be provided. Suitable for the storage of most liquids and viscous substances, they can be economically transported and erected in positions inaccessible to other forms of construction. They can also be increased in size when additional capacity is required. Illustrated brochure will be sent on application.

*Selling Agents*

## THOS. W. WARD LIMITED

ALBION WORKS · SHEFFIELD

TELEPHONE: 26311 (22 LINES) · TELEGRAMS: "FORWARD · SHEFFIELD"

LONDON OFFICE: BRETTENHAM HOUSE · LANCASTER PLACE · STRAND · W.C.2

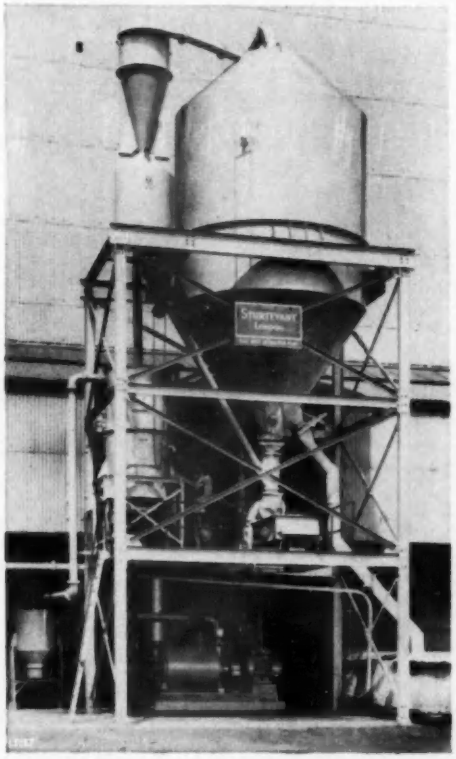
BT/25.

# STURTEVANT

## FLUE DUST EXTRACTION PLANT

**for the**

***CONTINUOUS* extraction of flue dust and grit from boiler hoppers whilst under steaming conditions**



This illustration shows a plant for six stoker-fired boilers for process steam at a large paper mill. Dust and grit from the hoppers are collected at the rate of about four tons per hour. Plant includes a Sturtevant Turbo-Exhauster and Receiver with dust conditioner to prevent dust escaping to atmosphere when discharging into a disposal lorry.

- **Eliminates manhandling of dust and grit.**
- **Gives cleaner conditions in the boiler house.**
- **Conveys dust and grit direct from boiler hoppers to central receiver.**

With the addition of a small bore piping system, complete vacuum cleaning of all surfaces can be carried out from hose connections placed at convenient points.

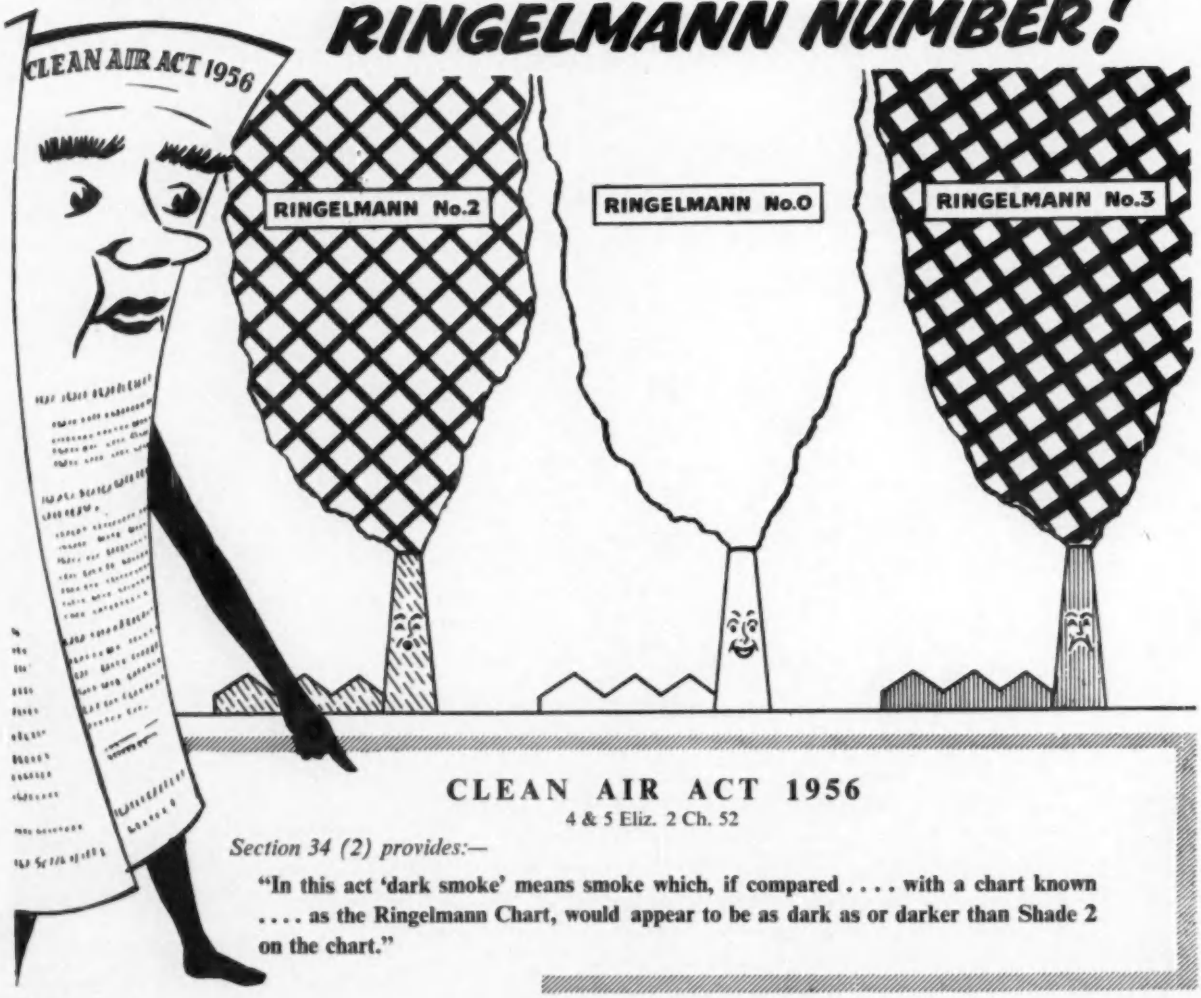
**Particulars may be obtained by writing to reference J/101/CWB.**

**STURTEVANT ENGINEERING CO. LTD.**

**Southern House, Cannon Street, LONDON, E. C. 4.**

AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W.

# What is YOUR RINGELMANN NUMBER?




**CLEAN AIR ACT 1956**
4 & 5 Eliz. 2 Ch. 52

*Section 34 (2) provides:—*

**"In this act 'dark smoke' means smoke which, if compared . . . . with a chart known . . . . as the Ringelmann Chart, would appear to be as dark as or darker than Shade 2 on the chart."**

**No. 3 RINGELMANN**
IS A FLAGRANT OFFENCE UNDER THE ACT

**No. 2 RINGELMANN**
FAILS TO COMPLY WITH THE ACT

**No. 0 RINGELMANN**
IS ASSURED WITH THE

# OLDBURY
## CHAIN GRATE STOKER
*which anticipated the Clean Air Act by 14 years*

Today more than 5,000 Oldbury Stokers are serving industry, burning solid fuels in the widest variety, **EFFICIENTLY, SMOKELESSLY.** **Leave nothing to doubt. To comply with the Act, consult Edwin Danks at Oldbury or the nearest Branch Office.**

**EDWIN DANKS & CO. (OLDBURY) LTD.**
OLDBURY near BIRMINGHAM · Tel: (Stoker Division) Brierley Hill 7731
**LONDON · CARDIFF · GLASGOW · LEEDS · MANCHESTER · NEWCASTLE-ON-TYNE**

# Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

NOVEMBER 1958

VOLUME 73. No. 11


## Principal Contents


| | Page |
|---|---|
| EDITORIAL NOTE | 349 |
| POINTS AND POINTERS | 350 |
| ROGERSTONE POWER STATION | 352 |
| NEW 60-MW POWER STATION FOR N.C.B. | 359 |
| HINKLEY POINT—TEN MONTHS' CONSTRUCTIONAL PROGRESS | 364 |
| RECENT EQUIPMENT AND ACCESSORIES | 371 |
| OVERSEAS STEAM ENGINEERING PRACTICE | 376 |
| LATEST POWER PLANT PATENTS | 380 |
| NOTES—PERSONAL AND INDUSTRIAL | 384 |


*The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable*


*Published monthly by*

ENGINEERING REVIEW PUBLISHING CO. LTD.

19-20, NOEL STREET, LONDON, W.1

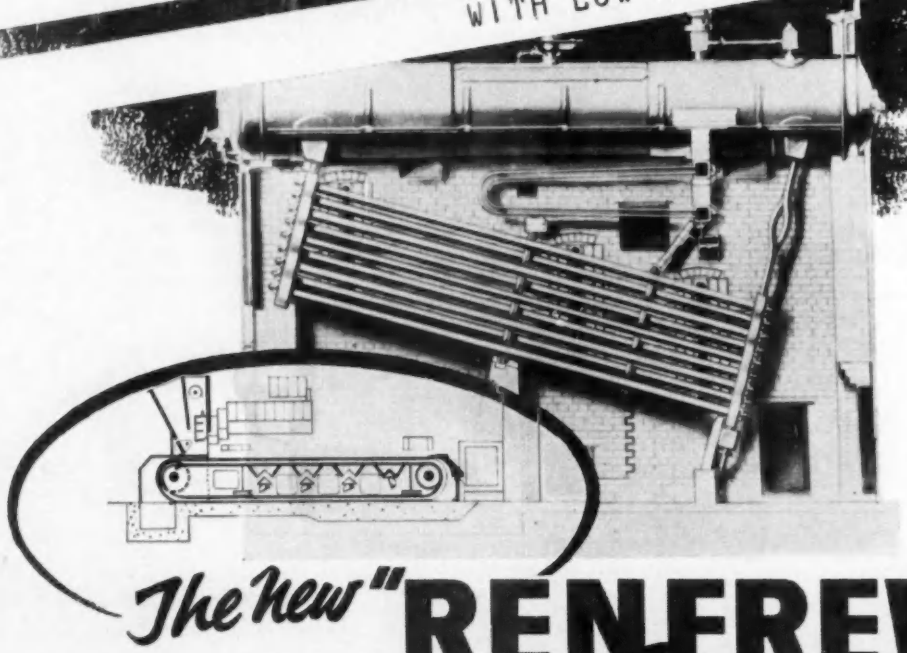
*Annual Subscription Rate, 40s., including postage.*

*Telephone*
Gerrard 8811

*Telegrams*
" Farsighted, Wesdo London "

# Hot News for industrial boiler users

"PACKAGED" STOKER ENABLES LOW-COST CONVERSION OF HAND-FIRED WATER-TUBE BOILERS TO ECONOMICAL SMOKELESS FIRING ★ WITH LOW-GRADE FUELS +



# The new "RENFREW" Stoker

***A new BABCOCK development, providing for the smaller sizes of water-tube boiler, up to about 25,000 lb./hr., all the cost-saving advantages of reliable mechanical firing:—***

**Readily adapted to existing water-tube boilers,** particularly to *hand-fired* units.

**Quickly, cheaply installed.** Delivered to site as a fully works-assembled unit.

**Low cost,** achieved by new design and modern methods of manufacture.

**Low running-cost.** Features formerly available only in large stokers, such as *full zonal air-control*, ensure efficient burning of the cheaper low-grade fuels, including small coal.

**High availability and low maintenance** are assured by sound engineering design and robust construction, using materials proved by long experience.

**Exclusive link design** and controlled manufacture of the links from special material, ensure extra long service and *efficient combustion with a minimum of riddlings.*

**A BABCOCK** stoker, backed by over 70 years experience in design and manufacture of chain grate stokers.

## ★ CLEAN AIR ACT

With its facility for application to existing boilers and its ability to provide *smokeless combustion* even with variable and low-grade fuels, the RENFREW stoker presents, at moderate cost, a highly effective means of meeting the requirements of the *Clean Air Act.*

*Ask for Publication No. 1700*

**BABCOCK & WILCOX LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON N.W.1**

Engineering and
BOILER HOUSE REVIEW

NOVEMBER 1958

VOLUME 73 No. 11

## THE ELECTRICITY REPORT

THE recently published annual Report of the electricity supply industry in England and Wales (covering the year ended March 31st, 1958) is a mine of information from which much important data can be extracted by careful study of its 300-odd pages. The industry has now been nationalised for ten years and thus the latest report enables one to summarise a decade of progress under public ownership. In this period, the installed capacity of generating plant has increased from 11,680-MW in 291 power stations to 24,315-MW in 253 power stations; and the output ratings from 10,362-MW to 22,343-MW. From these figures it is interesting to note that the percentage of output capacity to installed capacity has risen from 88.7 per cent. to 91.9 per cent.

The net reduction of 38 in the number of power stations in commission has, of course, been brought about by the closing down of a large number of small stations and the building of larger ones. For example, in 1948, the stations with an installed capacity of under 25-MW numbered 188; these have been reduced to 91; whereas the stations with installed capacities of from 25-MW to 300-MW and over, have increased in number from 107 to 162. One section of the Report dealing with plant design and development is especially interesting. It records that the plant programme for 1963 (which was prepared in 1957-58) includes one conventional generating unit of 550-MW installed capacity, one of 300-MW, one of 275-MW, three of 120-MW and two of 100-MW. One of the important economic gains derivable from the larger, higher-pressure, higher-temperature sets is that they generate more electricity per ton of coal. It is, for example, anticipated that the highest thermal efficiency from the plants projected for 1963 may be approximately 36 per cent., indicating a heat consumption rate of about 9,478 B.Th.U.'s per kWh, with which one may compare the average of 13,375 B.Th.U.'s per kWh sent out from steam stations last year.

It hardly needs pointing out that such a saving in fuel consumption (and costs) is immensely important. But savings do not end there. By increasing the size of generating sets, the building volumes of conventional power stations for the largest sets on order have been reduced by about 44 per cent.; that is, from 50 to 28 cubic feet per kilowatt installed. By advances such as these, it has been possible, despite an overall increase during the ten-year period of some 70 per cent. in the cost of materials and labour, to keep the capital costs of new conventional power stations constant at an average figure of about £50 per kW installed.

Operationally, the progress of the industry over the past ten years has been equally impressive. The number of kWh sent out from the power stations has grown from 36,391 millions in 1947/48 to 81,303 millions in 1957/58, an increase of 123.4 per cent.; and the number of kWh sold to consumers has grown respectively from 32,669 millions to 72,661 millions. The proportion of units sold, to units sent out, remains practically unchanged at approximately 89 per cent. The growth of electricity sales may be better appreciated, however, from the figures of average consumption per head of population, which was 789 units in 1947/48 and 1,585 units in 1957/58.

The average thermal efficiency of generation at steam power stations has improved steadily from 20.91 per cent. in 1947/48 to 25.51 per cent. in 1957/58. The latter figure would have been higher were it not still necessary, in order to meet peak loads, to keep in commission many generating sets and boilers which are old, small, and expensive to operate. There has also been some improvement on the actual system load factor which for 1957/58 is recorded at 48.0 per cent. on a maximum demand of 19,311-MW, compared with 45.8 per cent. on a maximum demand of 9,100-MW in 1947/48. From the financial point of view, the trading result of the industry as a whole for the year 1957/58 was a surplus of £16.06 million, an increase of £4.34 million over the previous year, but still representing only 3.39 per cent. of the combined revenues, and only a fraction of 1 per cent. of the capital invested in fixed assets.

# Points and Pointers

*E.R.A. OVERSEAS SECTION* Although the work of the Electrical Research Association (E.R.A.) has long been well-known in Great Britain, its activities are perhaps less familiar overseas. Accordingly, an overseas liaison unit has recently been established by the E.R.A., under the responsibility of Mr. E. W. Golding, O.B.E., who is also head of the Association's rural electrification and wind power department. The main aim of this new section will be to maintain close contact with electrical engineering activities overseas, to improve the service given to E.R.A. members in the Commonwealth, and to ensure that full advantage is taken of the services which the Association can offer, and that its researches shall cover the widest possible range of interest. The work of the Association includes research programmes on a large number of subjects which are of interest to its members—electricity supply authorities, manufacturers of engineering plant and users of electrical energy. In addition to the research facilities provided in its own laboratories and field stations, the E.R.A. has the advantage of being able to undertake co-operative researches in collaboration with its members, and with other research organisations interested in related subjects. Many of the problems facing electrical engineers in Commonwealth countries are almost identical with those met in Britain, but there are others, peculiar to different areas, climates and economic conditions, which call for special consideration. It is believed, however, that such problems could be solved by the E.R.A., either through some modification of existing research to include these new aspects or, perhaps, by initiation of new programmes framed to meet overseas requirements. The first step towards the solution of any problem must be to gain a clear understanding of the exact nature of the question to be answered. As one attempt to overcome the handicap of long distances which preclude verbal discussions except on a few random occasions, an overseas newsletter has been initiated. The first issue of *The E.R.A. Overseas Newsletter* has just been prepared and its successors will be sent out at six-monthly intervals. Its purposes are to outline the research work of the E.R.A., with special emphasis on programmes which may interest Commonwealth members; to give brief notes on past and forthcoming electrical engineering meetings, conferences and other similar activities in Great Britain; to call attention to recent developments by British electrical engineering manufacturers; and to provide a medium for the exchange of views and experiences between Commonwealth members in different parts of the world. That there are common problems which could be solved by co-operative efforts is almost certain; the present object of the E.R.A. is to take the initiative in bringing these problems to light. Inquiries should be addressed to Mr. E. W. Golding, O.B.E., Overseas Liaison Officer, The Electrical Research Association, Savoy Place, London, W.C.2.

*INCORPORATED PLANT ENGINEERS* The transfer of the Institution's headquarters from the Midlands, to 2, Grosvenor Gardens, London, S.W.1, marks an important stage in the progress of Incorporated Plant Engineers, which had its origins in the second world war when the engineers in charge of the large American excavators imported for working open-cast coal met together for the exchange of information and mutual help. The meetings proved so beneficial, that the engineers concerned decided to continue them through the medium of an Institution; the Memorandum of Association of Incorporated Plant Engineers was signed on September 3rd, 1946. Its aims attracted engineers in many fields, and within a year, there were branches holding monthly meetings in London, Birmingham, Manchester, Leeds, Newcastle, Glasgow, and Bristol. The following year saw a further six branches established, and by 1954 there were eighteen branches in the United Kingdom and one (Bombay) overseas. Membership, which at the end of 1946 was 120, is now nearly 4,000, of whom more than 500 are overseas members. The Institution recognises that the term "plant engineer" covers a wide range of people and functions, and has framed its membership requirements so that applicants with modest academic qualifications are not necessarily excluded. A plant engineer is defined as one who, by virtue of the combination of his education, training and experience, is able to assume personal responsibility for the development and application of engineering science and knowledge in research, development, specification, design, construction, manufacture, management, and the education of other plant engineers. The increase in the extent of mechanisation of industrial installations, and the complicated nature and high cost of new equipment, have greatly increased the responsibilities of the plant engineer. He must be a highly competent engineer with a wide background of knowledge and experience, to enable him to adapt himself to the currently rapid changes in the technology of the equipment for which he is responsible. Education and training have been a main concern of the Institution from its inception, and the Education Committee (one of the first to be appointed by the Council of the Institution, as early as February, 1947) took a major part in the establishment of the City and Guilds of London Institute's certificates in Plant Engineering. Another of its main activities has been the organisation of the remarkably successful refresher courses for senior works and plant engineers, which are held each winter at university level, in various industrial centres. The Institution holds an annual national conference in May, and regional conferences are held periodically. In addition, general meetings are held in London, and at the headquarters of the various branches for the presentation and discussion of technical papers of national interest. The journal of the Institution, recording its transactions, is published in alternate months.

*ART AND ENGINEERING*

Mr. A. A. Part, head of the further education branch at the Ministry of Education, speaking recently at the Administrative Staff College, Henley, said that if the technical colleges continued to expand at the present rate they will succeed in providing their share of the extra 10,000 technologists per year estimated to be needed by 1970. This would be, in the words of the Advisory Council on Scientific Policy, "a remarkable educational achievement." It was, however, most important that the quality as well as the quantity of technical education should be improved. One of the methods being tried for this purpose was to liberalise the education in the colleges. "Liberalisation" would take several forms, including the provision of hostels and the strengthening of student unions; but above all it involved broadening the treatment of technical subjects and introducing some formal liberal studies. On the whole, he thought that in present conditions, liberal studies allied to the technical subjects concerned would be more likely to succeed than those which were not. A year ago the Ministry had published a circular on the subject. The "Hives Council" (National Council for Technological Awards: Chairman, Lord Hives) had welcomed this circular and had said that they would expect all courses, designed to lead to the Diploma in Technology, to show a breadth of outlook and content reflecting a combination of formal liberal studies and informal activities. The Ministry hoped that one possibility which the colleges would consider as a formal liberal study was art. Whatever the art schools might do in the way of courses in product design—and he was sure that the new National Advisory Council on Art Education, under the chairmanship of Sir William Coldstream, would have recommendations to make on this score—the Ministry believed that the problem ought to be approached from the technologist's angle as well. Technologists would, one hoped, increasingly find themselves co-operating with industrial designers trained in art schools, and it was important that they should have some understanding of the artist's point of view. Then, again, there would no doubt be many cases in which a product involving fairly complex engineering considerations would need to be designed by an engineer with an appreciation of aesthetic principles, rather than by an artist with some knowledge of engineering.

*INDUSTRIAL ASPECTS OF THE CLEAN AIR ACT*

At the annual conference at Llandudno (October 1st to 3rd) of the National Society for Clean Air, one of the sessions was devoted to a study of the industrial aspects of the Clean Air Act. Three papers were presented for discussion. The first of them was by Mr. G. W. Farquharson, Birmingham's chief smoke inspector, who dealt with the control of dark smoke emission. He pointed out that, with the exception of the scheduled processes controlled by the alkali inspectors of the Ministry of Housing and Local Government, the responsibility and duty of ensuring the implementation of the new legislation appertaining to the control of dark smoke emission in England and Wales was placed directly on all local authorities. Mr. Farquharson added that, in his opinion, the full implementation of the legislation by local authorities required constant supervision for contraventions, co-operation with offenders through the strength of enforcement, and the determination of the contraventions through legal proceedings if co-operation failed. He suggested that the control of dark smoke could be achieved if the representatives of local authorities accepted the responsibilities that the full implementation of the Act involved. The common practice of waiting for smoke nuisance complaints from the public before taking action, he remarked, was over; all areas should be subject to constant inspection, and contraventions should not be allowed to persist. The second paper, presented by Mr. T. M. Ashford, was entitled "Grit and Dust Emission: Methods of Practical Control and Regulations." The major part of this paper dealt with an account of the various methods of dust and grit measurement and control. The final paper was by Mr. N. Bastable on "The Height of Chimneys." Mr. Bastable pointed out that, in power stations and large industrial plants generally, the function of a chimney was solely to secure adequate and satisfactory dispersal of the flue gases. The draught needed for the furnaces could more easily and cheaply be provided by fans. In smaller plants, however, the chimney still played its part as a draught creator and, unless it was well-designed, poor burning and smoke emission would result. Mr. Bastable acknowledged, however, that there would be many cases in which a compromise had to be agreed, in designing chimneys, between preserving the amenities of the district and preventing pollution of the atmosphere in the neighbourhood.

*BRUSSELS EXHIBITION AWARD*

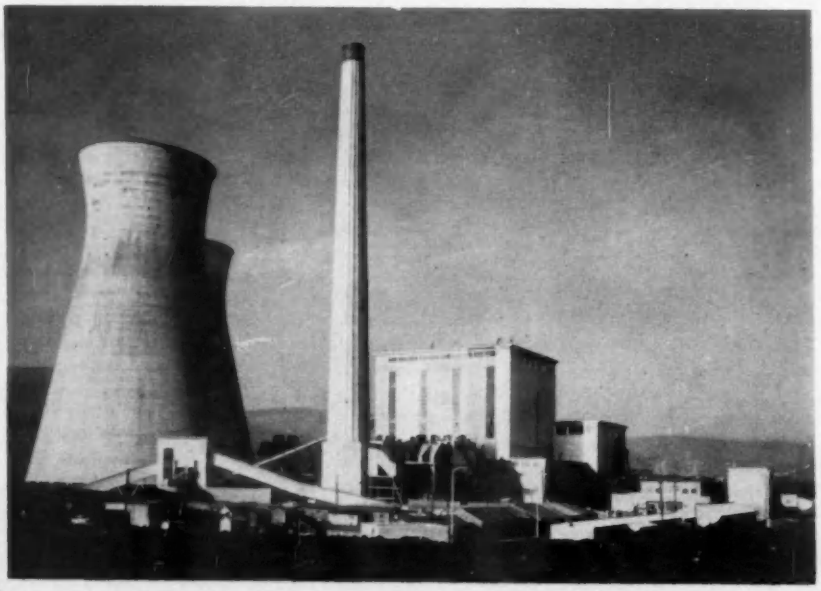
An international jury appointed by the authorities of the Brussels International Exhibition has awarded the Supreme Grand Prix for exhibits concerned with the exploitation of nuclear energy to the Nuclear Power Plant Co. Ltd., Knutsford, Cheshire. This class of exhibit was one of the largest and most important in the exhibition, and the award has been won in competition with many other exhibitors. The N.P.P.C. exhibit occupied the largest single stand in the British Industry pavilion. It was 83-ft. long and 58-ft. wide, and consisted of a scale-model of a 400-MW two-reactor nuclear power station. The station depicted is comparable in basic design and layout to the actual 300-MW station which the company is building for the Central Electricity Generating Board at Bradwell, Essex, but developments since work began on the latter now make it possible to obtain an output of 200-MW, instead of 150-MW, from each reactor, with no appreciable increase in size or cost. The station which N.P.P.C. is to build at Latina, near Rome, on which preparatory work has already begun, will have a single 200-MW reactor. In the model, one of the reactor buildings was sectioned to show the pressure-vessel, two of the six boilers and the gas-ducting. The control-rods could be seen in movement, and the operation of the reactor was simulated by illuminating the core in red when active, and in green when shut down. The boiler tubes were transparent, and contained bubbles which circulated and changed colour in order to indicate changes in temperature. The turbine hall section of the model was built partly of transparent material to show the four main and three auxiliary turbo-alternator sets.

# Rogerstone Power Station

ROGERSTONE power station, formally opened on October 30th, 1958, by Sir Christopher Hinton, K.B.E., F.R.S., chairman, Central Electricity Generating Board, is operated by the South Wales Division, C.E.G.B. The station, which has an output capacity of 120-MW, occupies a site of some 90-acres, approximately three miles from Newport, on the eastern bank of the River Ebbw, and is the fourth new station to be commissioned in the area controlled by the Division since the end of the last war ; the others being Llynfi (120-MW), Uskmouth (360-MW) and Carmarthen Bay (345-MW). Projected new stations are Aberthaw (600-MW) and Uskmouth "B" (360-MW). Due to the nature of the sub-soil encountered on the Rogerstone site, which contained large boulders, conventional pile-driving was not feasible and therefore Beneto machines were employed to sink one-hundred and forty-nine 1-metre dia. cast *in-situ* piles for the main station building foundations. These were of an average length of 65-ft., each pile being capable of withstanding a load of up to 300-tons. Work on the foundations started in May, 1955, some three months after piling commenced, and No. 1 boiler was commissioned at the end of August, 1957. No. 1 turbine was synchronised and commissioned on September 17th, 1957, only three years from the date work first commenced on the site. The main station buildings are of steel-frame construction, clad with brickwork to a height of 38-ft., above which, the cladding comprises light-weight fluted aluminium sheeting with a glazed section immediately below roof level. The boiler house roof is of reinforced-concrete, and the turbine house roof of pressed-steel sheets covered with bitumenised waterproofing. The overall dimensions of the buildings are 140-ft. high, 226-ft. long and 360-ft. wide. Messrs. Kennedy and Donkin, and Sir Bruce White, Wolfe, Barry and Partners were the plant and civil engineering consultants respectively, and the executive architect was Sir Percy Thomas, O.B.E., J.P., D.L., LL.D., P.P.R., B.A. Sir Robert McAlpine & Sons (South Wales) Ltd. were responsible for the foundations and superstructure, while the single, 350-ft. high, reinforced-concrete chimney was constructed by J. L. Keir & Co. Ltd.

**Coal-handling plant**

Coal is delivered in rail wagons, which are handled by capstan marshalling equipment, and discharged by two "Rotaside" tipplers supplied by Strachan & Henshaw Ltd., and incorporating Avery weighers. The tipplers can deal with trucks of 10 to 24-tons capacity and can discharge at a rate of 130 to 270-tons/hr., according to the weighing cycle. Five 30-in. wide belt conveyors, running at average speeds of 365-ft./min., and of 250-tons/hr. capacity, convey the coal to the boiler bunkers. Alternatively, coal can be taken out to stock via a 250-tons/hr. radial conveyor, the actual stocking out being done by mobile equipment. This equipment is also used for reclaiming into a hopper discharging through vibratory feeders on to a 150-tons/hr. conveyor, which in turn delivers to the main conveyor system to the coal bunkers. An "Adequate" belt-weigher supplied by Adequate Weighers Ltd., Sutton, Surrey, is incorporated in the conveyor system to weigh coal being conveyed to the boiler bunkers either from the tipplers or from stock, and there is provision for the sampling of coal from either of these sources. A special trash-screen is provided to



*Rogerstone power station in Monmouthshire is now completed with an installed generating capacity of 120-MW—comprising two C. A. Parsons 60-MW turbo-alternator sets and two Babcock & Wilcox 550,000 lb./hr. radiant type boilers.*

remove trash both from the main coal stream and from coal reclaimed from stock, and both magnetic pulleys and overband magnetic separators are incorporated in the conveyor system for removing tramp iron. The coal-handling plant is designed to deal with coal in sizes from 12-in. to 0-in. Sizes above 1-in. are rejected by a main screen and are transferred to a 150-tons/hr. mud hog crusher.

**Boiler plant**

The boiler plant comprises two Babcock & Wilcox radiant type, single-drum units, each designed for a maximum rating of 550,000-lb./hr.—the temperature and pressure of the steam at the superheater outlet being 925 deg. F., and 950-lb./sq. in., respectively. Feed temperature at m.c.r. is 385 deg. F. The boilers are suspended from the boiler-house structural steelwork so that all expansion takes place vertically downwards; therefore no separate boiler supporting steelwork is provided. The furnace, which has a volume of 62,000-cu. ft., is arranged for opposed firing with eight vertical multi-tip intertube p.f. burners in each side wall. Thus there are sixteen burners per boiler furnace. The furnace front and rear walls are of tangent tube construction, and the side walls comprise studded bare tubes. The Babcock & Wilcox superheater for each boiler is of the multi-loop type arranged in two sections—primary and secondary. The primary (low temperature) superheater is again in two sections, viz., one pendant (6,760-sq. ft.) and one horizontal (12,750-sq. ft.), (total 19,510-sq. ft.), while the high temperature secondary section has a heating surface of 7,850-sq. ft. Between the primary and secondary sections there is provided an interstage spray type attemperator which automatically maintains the final steam temperature at 925 deg. F. $\pm$ 15 deg. F.

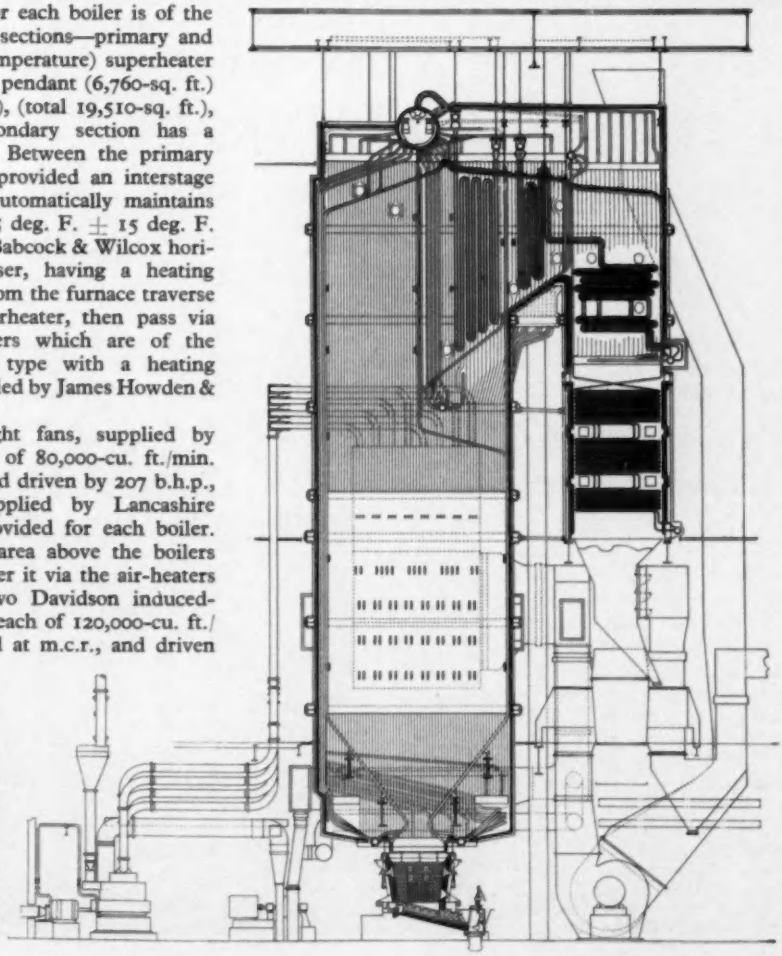
Each boiler is provided with a Babcock & Wilcox horizontal multi-loop type economiser, having a heating surface of 26,000-sq. ft. Gases from the furnace traverse the various sections of the superheater, then pass via the economiser to the air-heaters which are of the Ljungström rotary regenerative type with a heating surface of 67,500-sq. ft., and supplied by James Howden & Co. Ltd.

Two "Sirocco" forced-draught fans, supplied by Davidson & Co. Ltd., and each of 80,000-cu. ft./min. capacity at 80 deg. F. at m.c.r., and driven by 207 b.h.p., 740 r.p.m., 3.3-kV motors supplied by Lancashire Dynamo & Crypto Ltd., are provided for each boiler. They draw warm air from the area above the boilers inside the boiler house, and deliver it via the air-heaters to the boiler furnaces. The two Davidson induced-draught fans, for each boiler are each of 120,000-cu. ft./min. capacity at 230 deg. F. and at m.c.r., and driven by 414 b.h.p., 740 r.p.m., 3.3-kV Lancashire Dynamo & Crypto motors. These fans draw the gases from each boiler and deliver them to the electrostatic precipitators which were supplied by Simon-Carves Ltd., and which remove 97.5 per cent. of the dust in the gas stream. Each precipitator is equipped with its own high-tension house and metal rectifiers, and is also arranged so that the elements can be changed while the precipitator unit is in operation.

All the sootblower equipment was supplied by Babcock & Wilcox Ltd., each boiler being provided with 40 blowers of three different types. For the furnace wall tubes there are twelve electrically-operated single-nozzle units, while the superheater is provided with fourteen "rack" type blowers. Six similar blowers are provided for cleaning the economiser tubes, and eight unidirectional mass-element blowers serve the two air-heaters associated with each boiler. All these sootblowers are electrically-operated with sequence control which provides for automatic operation of each blower in its correct sequence either through the full blowing cycle or with the omission of any preselected units.

**Firing equipment**

For each boiler there are four Babcock & Wilcox Type E 56 pulverising mills each of 9½ tons/hr. capacity, although any three mills can provide the requisite amount of fuel for a boiler to operate under full load conditions. Each mill which feeds a total of four burners, two in each side wall of the furnace, is driven by a 110 b.h.p.

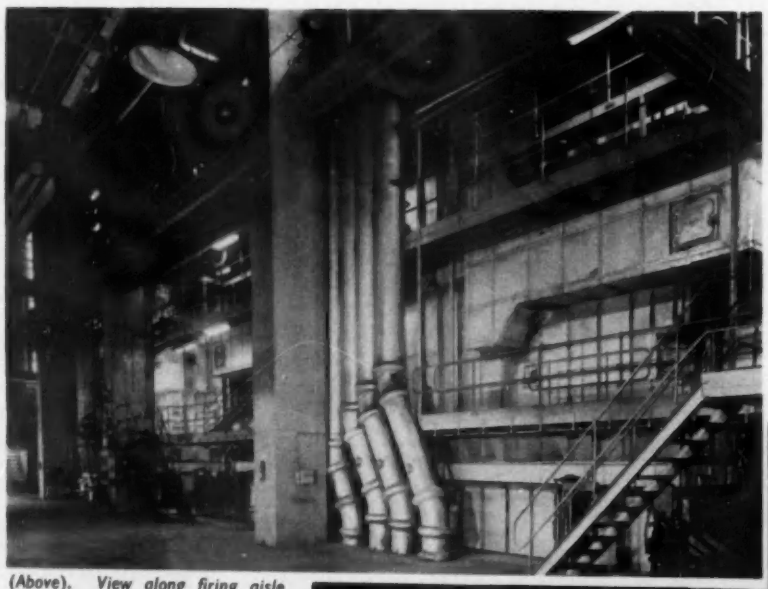


*Sectional outline arrangement of one of the Babcock & Wilcox 550,000 lb./hr. pulverised-fuel-fired radiant type boilers.*

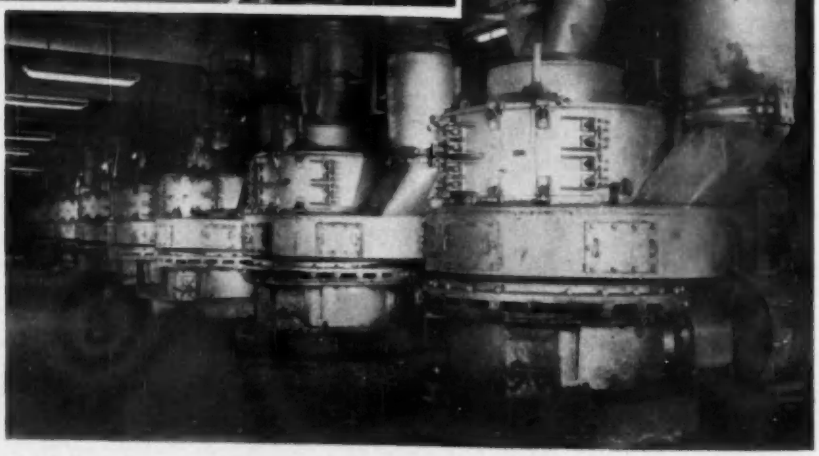
580 r.p.m. motor supplied by Lancashire Dynamo & Crypto Ltd. Coal from the boiler bunkers is delivered to each mill hopper either directly, or as required, through an automatic coal-weigher supplied by Richard Simon Ltd., and is fed into the mill by a variable-speed rotary table feeder driven by a Lancashire Dynamo 2½ b.h.p., 1,440 r.p.m. motor. For each mill there is a Davidson primary-air fan, the suction for which is taken from the main air-ducting before and after the air-heater. Each fan has a capacity of 41,000 lb./hr. at 27.5-in. w.g. and is driven by a Lancashire Dynamo 126 b.h.p., 1,470 r.p.m. motor. The sealing-air fan for each mill has a capacity of 200-cu. ft./min. at 40-in. w.g. and 80 deg. F., and was supplied by Keith Blackman Ltd.

For lighting-up purposes, each boiler is fitted with eight Babcock & Wilcox retractable type oil-burners, (four in each side wall), with pressure atomisers and automatic spark ignition. For this equipment, two Mirrlees 560 g.p.h. Imo pressure pumps, and two 200 g.p.h. Imo circulating pumps are provided. There is also a 132-kV oil-heater.

The boiler mountings and valves were supplied by Dewrance & Co. Ltd., and include boiler and superheater safety valves, of the Dewrance Consolidated Maxiflow type " full-lift " providing maximum discharge capacity. The superheater safety valves include one valve fitted with a solenoid for electrical operation. The boilers are also fitted with Dewrance external high and low whistle alarms. The boiler water-gauges are of fabricated construction, the upper and lower arms fitted with screwdown valves. The indicators are of the " loose-plate " type, and the units are complete with Dewrance patent bi-colour illuminated water-level indicators. The main steam stop-valves are of 12-in. bore, with internal pressure-held covers, and are installed complete with a Dewrance-Tate electrically-operated gear mounted direct on the valve. Dewrance 12-in. bore strainers of fabricated constructions, with removable internal strainer baskets, are included in the main steam lines, while the feed lines include 7-in. Dewrance parallel slide valves and non-return valves with pressure seal covers.



*(Above). View along firing aisle showing fronts of the two 550,000 lb./hr. Babcock & Wilcox opposed p.f. fired boilers.*



*(Right). Each boiler furnace has sixteen pulverised-fuel burners which are served by four B. & W. type E.56 mills. Thus there are eight mills for the two boilers.*

**Instrumentation and automatic control**

The boiler/turbine instrumentation and the automatic boiler control equipment was supplied by Electroflo Meters Co. Ltd. An instrument control-desk and recorder-panel were supplied for each of the two units, and these are situated in a central control room. The automatic boiler control provides a constant control of steam pressure, combustion rate, and combustion chamber pressure. The system combines a pneumatic loading system with hydraulically-operated power-cylinders, and the

individual regulators are of the " force-balance " measuring type. The use of hydraulic power cylinders ensures positive and instantaneous response, especially when the torque figures are high. The desired steam pressure is maintained by means of a master controller which is connected to the steam header and converts the changes in steam pressure, which occur with variation in load, into an air-loading pressure for transmission to the individual regulators controlling the combustion rate. Combustion air is controlled by the air-flow regulator. Inlet vanes of the two f.d. fans are operated in parallel by two receiving regulators which are loaded from a sender relay in the measuring regulator. Air-flow differential is measured in each of the f.d. fan inlet ducts by pneumatic transmitters, the output from these transmitters being summated and the result applied to the measuring regulator balanced against the main loading pressure. For abnormal conditions and changes in fuel quality, corrections are made to the air-flow by the steam-flow/air-flow regulator, which maintains automatically a definite ratio of steam evaporated, to combustion air used. The furnace pressure is held constant by the i.d. fan regulator. The two i.d. fans are operated in parallel by two receiving regulators which are loaded from a sender relay in the measuring regulator. This regulator measures the combustion chamber pressure, and is independent of the master controller. Primary-air regulators control the air-flow to the coal pulverising mills by operating a damper in each primary-air duct. Mill tempering-air regulators are also provided to maintain constant temperature at the mill outlet. These operate cold-air dampers at the mill inlet. Control of feedwater flow maintains a constant level of water in the steam drum. This regulator, operating the feedwater control valve, receives pneumatic impulses from three transmitters measuring steam flow, feedwater flow, and drum level. The exerted forces are so arranged that feedwater flow requirements, to maintain constant drum level, are anticipated by changes in steam flow. Auto/manual sub-panels are provided on the unit control-desk to permit the operator to transfer the boiler from automatic steam pressure control to unified manual control, or alternatively, individual operation of all regulators.

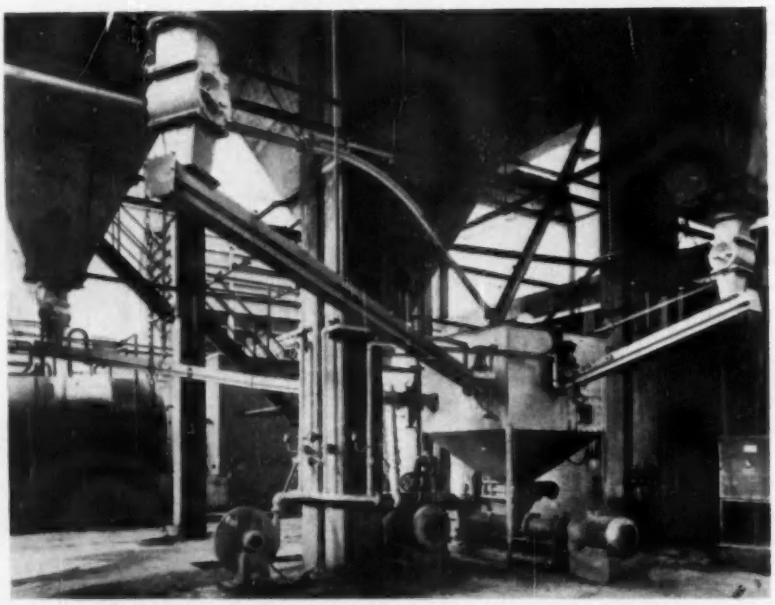
**Damper control equipment**

Lockheed electro-hydraulic damper controls supplied by Automotive Products Ltd., and giving power-hydraulic operation for thirteen points on each boiler, and incorporating automatic closing for the f.d. and i.d. fan discharge dampers in the event of fan motor stoppage, are provided. Manual-hydraulic control is also incorporated for use in the case of power failure or other emergency. All necessary controls are installed in desk-type control panels in the central control room, and include selector-switches to bring the desired damper into circuit for operation, and pistol-grip type " two position on and off " switches to give " opening " or " closing " movement of the selected damper as required. Limit indication, by means of two signal lights on the control desk, is employed for all the dampers operated, and no regulating type indicators are employed. Selection of a given damper for operation also brings its limit indication switch unit into circuit with the signal lights. The electrical control " instigation " units on the control desks are connected by multi-core cables to the Lockheed electro-hydraulic control cabinets, in which are housed the solenoid-operated selector valves and the motor-pump units to provide the necessary operating fluid pressure, together with the necessary contactor starters, relays and other ancillary units. In addition, each cabinet incorporates a hand-operated pump to provide fluid pressure for emergency operation. On each boiler the f.d. and i.d. fan discharge dampers are actuated by Lockheed high-duty cylinders of the non-Autoloc type of $1\frac{1}{4}$-in. bore and 10-in. stroke, and hydraulic locking is provided by means of hydroloc valves. The air-heater air outlet dampers are operated by two $1\frac{3}{4}$-in. bore 10-in. stroke Autoloc cylinders, and the air-heater bypass dampers by four $1\frac{1}{4}$-in. bore, 10-in. stroke cylinders, connected in pairs via hydroloc valves to give hydraulic locking, while the tempering air dampers are controlled by two $1\frac{1}{4}$-in. bore, 6-in. stroke Autoloc cylinders. Further Autoloc cylinders are employed for the economiser outlets and for the air duct hampers. As already mentioned, the controls are arranged to give automatic closing of the i.d. and f.d. fan discharge dampers in the event of fan-motor failure. This action is brought into operation by an additional pair of contacts in the fan-motor circuit, which, via relays, start the pump-motor unit and energise the appropriate solenoid of the electrically-operated selector-valve to give actuation of the required damper in the closing direction, also putting the other controls temporarily out of action until the necessary automatic closing is completed. Additional limit-switch units, mounted near the operating cylinders, break the auto-closing circuit as the damper nears the fully-closed position, and time-delay relay units are employed to ensure that the dampers reach the fully-closed position.

**Ash and dust-handling plant**

The ash and dust-handling plant was supplied by Babcock & Wilcox Ltd. For handling the coarse ash, a Babcock Hydrojet high-velocity sluicing-type plant is employed, in which the ash is collected in a dry-type hopper below the furnace, being removed intermittently and discharged to a sluiceway in the basement where it is conveyed to a pit, from which it is removed by an overhead grab and loaded into road vehicles for disposal. Water for sluicing is recirculated from a reservoir arranged above ground-level, in such a way that the slurry collected in the bottom of the reservoir can be discharged from time to time on to the top of the ash in the pit, thereby eliminating the difficulties of sludge removal associated with a system employing a recirculating reservoir at or below the ash-pit level. Disposal of the fly-ash collected in the hoppers on the boiler and its auxiliaries is carried out in a plant of the Babcock low-pressure pneumatic type. The hoppers are arranged for storage, so that the plant is again an intermittent one, employing airslides and jet-blowers to convey the dust from all points of collection to a common buffer hopper at each boiler. On the underside of the buffer hopper a Fuller-Kinyon pump and compressor is arranged to pump the dust, under pressure, to a silo positioned alongside the ash-pits. The dust is then passed through paddle-type dust conditioners loading into road vehicles. The electric motors provided to drive the pumps incorporated in the

ash and dust-handling system were supplied by Lancashire Dynamo & Crypto Ltd. The largest units are the two associated with the high-pressure pumps, rated at 175-h.p., and running at 1,460 r.p.m. Lancashire Dynamo also supplied the motors for the airslide fans and the mixer conveyors.



*Babcock & Wilcox low-pressure pneumatic fly-ash handling plant, showing dust valves, "airslides," Fuller-Kinyon dust pump and air compressor, and fan.*

The Darlington Insulation Co. Ltd. carried out the complete heat insulation for the two boilers. The boiler drum, boiler and furnace walls, and superheater were covered with varying thicknesses of either Darlington 85 per cent. Magnesia slabs, or if the temperature so warranted, Darlington high-temperature Meta-Dextramite slabs followed by 85 per cent. Magnesia slabs, reinforced and supercoated with ½-in. hard-setting composition. The boiler drum insulation was further protected by sheet-metal cleading. The economiser ends were insulated with Magnesia slabs, and to obtain efficient sealing, were finished with ACl, followed by a layer of Flintkote ; the side walls being similarly insulated and finished, as in the case of all of the draught plant ducting, air-heater and p.f. burner casings, with Kimoloboarding held in position with channel banding. In the case of the draught plant ducting, air-heater and p.f. burner casings, special sheet-metal boxes were made to cover the flanges, and expansion joints. The i.d. fans and external ducting was insulated with a ½-in. hard-setting composition, weatherproofed by Flintkote. The main steam piping was insulated with Darlington high-temperature Meta-Dextramite sections, followed by Darlington 85 per cent. Magnesia sections reinforced and supercoated with ½-in. hard-setting composition, with open-mesh hessian trowelled in ; whilst the feed pipe insulation was Magnesia sections reinforced and supercoated with ½-in. hard-setting composition. On this piping, and on much of the other piping throughout the station, the Darlington company used a special form of insulation expansion joint which they claim has proved to be very successful. The Darlington Insulation Co. Ltd. were also responsible for the insulation of the oil fuel tanks which are situated outside the boiler house. These were covered with Darlington 85 per cent. Magnesia slabs, reinforced, and finished with ½-in. hard-setting composition and weatherproofed with Flintkote.

**Turbo-alternator plant**

The two 60-MW turbo-alternator units, together with their associated condensers and feed-heating plant, were supplied by C. A. Parsons & Co. Ltd. Each turbine is designed to operate with inlet steam conditions of 900 lb./sq. in., and 900 deg. F., with the low-pressure cylinder exhausting at 28.9-in. Hg. Both machines are of the three-cylinder type, fitted with reaction blading throughout. A clamped type of horizontal joint is employed for the high-pressure cylinder in place of the conventional bolted joint. Two steam chests are provided, one on each side of the high-pressure cylinder, and each containing a runaway stop-valve and one governor-valve. These valves are operated by high-pressure oil supplied through the oil pump driven from the end of the high-pressure turbine shaft by a worm and wheel gear. The steam expands in the high-pressure cylinder from 600 lb./sq. in. down to approximately 240 lb./sq. in. and is then led through four pipes, two below and two above the turbine house floor level to the intermediate pressure cylinder where it is expanded down to 17.2 lb./sq. in. abs., and then finally through two overhead pipes to the low-pressure cylinder where it is further expanded down to the exhaust vacuum of 28.9-in. Hg. Arrangements are made to extract steam from the turbine at five different pressure points in order to heat the condensate returning to the boiler to a temperature of 385 deg. F. The steam exhausting from the low-pressure cylinder of each turbine is dealt with by a single condenser of the triple-flow type, having a cooling surface of 57,000 sq. ft. Two full-capacity three-stage air-ejectors are installed to maintain the exhaust vacuum, and two full-capacity horizontal two-stage extraction pumps deal with the condensate. Each hydrogen-cooled generator has a rating of 60-MW at 0.8 p.f., generating at 11.8-kV. A modified form of the Parsons multiple-path cooling system has been adopted for these units, with the complete gas circuit contained within the stator casing. Fans mounted at each end of the rotor, supply hydrogen to the pressure compartments of the stator casing, from which it passes by various paths in the stator to adjacent exhaust compartments and then to the coolers before re-circulation. The exciter unit of each set is driven from the main rotor-shaft through reduction gearing

at a speed of 1,000 r.p.m., and comprises a main and pilot exciter, both armatures being mounted on the one shaft and their field magnets assembled in the same frame. Ventilation is provided by filtered-air being circulated by a fan on the high-speed pinion shaft of the gearing.

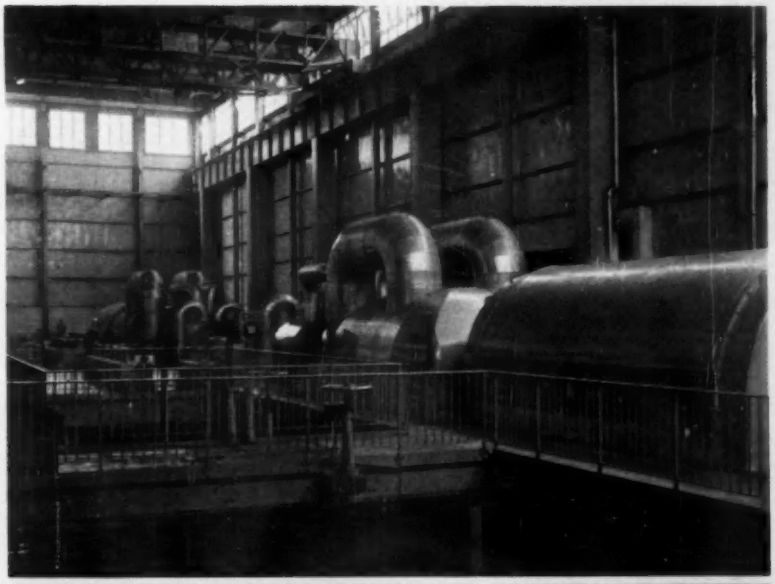
Each alternator is solidly connected to a 75-MVA, 11.8/66-kV generator transformer. The generator transformers are forced-oil air-blast cooled, in two sections with on-load tap-changing. The h.v. side of the transformers is connected to the 66-kV substation English Electric circuit breakers. The outdoor substation has fourteen 1,500-MVA bulk oil circuit breakers. Two of the nine outgoing overhead lines feed into a 132-kV substation at Llantarnam, one into the 66-kV system at Upper Boat, while six are for the Area Board distribution system.

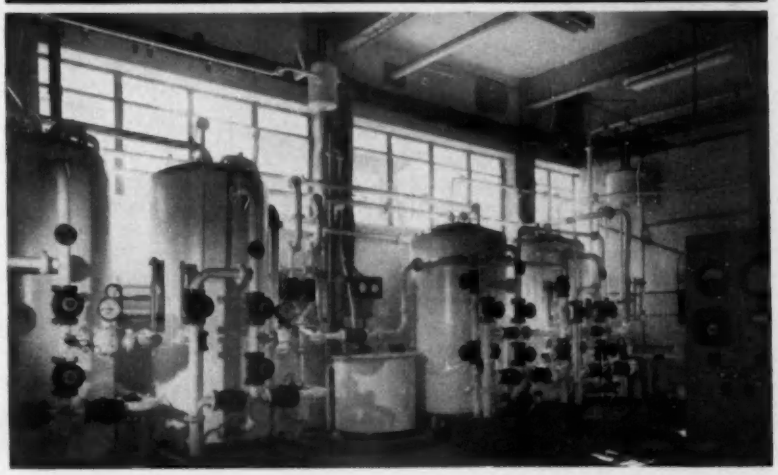
**Deaerators**

The deaerators were supplied by William Boby & Co. Ltd., each unit being designed for an output of 520,000 lb./hr. of water delivered to the feed pumps at 260 deg. F. The oxygen residual guarantee is 0.005 c.c./litre, but we understand that the deaerators have consistently, since their commissioning, returned figures below this. Each deaerator is equipped with a storage tank having a capacity equivalent to ten minutes' full load running of the plant. Hydraulically-operated level-control valves are fitted and operate from the level in the deaerator storage tanks. The deaerators are of the variable pressure type, the pressure in them varying according to the load on the turbine. An auxiliary supply of steam from a higher pressure bleed belt on the turbine is automatically admitted to maintain the deaerator pressure above atmosphere at low loads where the normal deaerator bled steam pressure falls below this. A special bled steam non-return valve is used in the deaerator bled steam line. External vent condensers are used, utilising the incoming water as cooling water.

**Boiler-feed pumps**

The three boiler-feed pumps installed were supplied by Sulzer Brothers (London) Ltd. They are electrically-driven, six-stage units of the horizontal, high-temperature and pressure barrel-casing type. Each pump is capable of delivering 650,000 lb./hr. against a total differential pressure of 1,150 lb./sq. in., with an inlet temperature of 260 deg. F., and when running at a speed of 2,970 r.p.m. The pumps are of the well-known Sulzer design, and are provided with casings of cast-steel with cast-on suction and delivery branches, and cast-on feet for centre-line mounting. The end covers are of forged-steel, the impellers and guide wheels of nickel-chrome steel. As is usual in the Sulzer design of pumps of this type, the hydraulic end thrust is automatically-controlled by the balancing device with a balancing ring of forged chrome-steel and balance wearing bush of alloy-steel. Each pump is provided with a non-return valve and thermostatically-controlled leak-off equipment made by Hopkinsons Ltd., and of the differential-type, set to operate when the temperature differential between water entering the pump and that leaving the balancing device reaches a pre-determined figure. The motors are of Metropolitan-Vickers' manufacture, and are of the drip-





*(Above). The two 60-MW turbo-alternators which were supplied by C. A. Parsons & Co. Ltd.*
*(Below). The water-treatment plant of 4,300 gal./hr. capacity was supplied and installed by The Permutit Co. Ltd.*

proof squirrel-cage induction type with ring-oiled water-cooled bearings, each motor having a continuous rating of 1,275-b.h.p. at a speed of 2,980 r.p.m. and being wound for 3,300 volts, 3-phase, 50 c/s.

A total of 4½-million gal./hr. of cooling-water is required to condense the exhaust steam from the turbines, and as the minimum flow of the River Ebbw is insufficient to provide this quantity, two cooling-towers have been provided. The cooling towers were constructed by Film Cooling Towers (1925) Ltd., and each is designed to cool 2,250,000 gal./hr. from 84 deg. F. to 68 deg. F. The principal dimensions of the towers are 286-ft. high above cill level and 180-ft. dia. at the distribution trough level (which is 27-ft. above the cill), the throat dia. being 100-ft., and the flare dia. 116-ft. The irrigation system comprises parallel "Everite" cement-asbestos piping fed from a central tapered, inclined reinforced-concrete culvert. The splash-bar packing is supported on pre-stressed reinforced-concrete beams. A special characteristic of these towers, as with most large towers of this company's design, is the use of additional depth of packing in the centre of the tower, which becomes possible only by the employment of spear-point laths at the air inlet; these laths ensuring unrestricted air flow to the centre of the tower. De-icing arrangements are incorporated, together with a single-pass mist eliminator.

Wallace & Tiernan automatic intermittent chlorination plant is installed for treatment of the condenser cooling water, in order to eliminate slime fouling of the condensers. The plant is designed to operate under automatic programme control, treating intermittently and in turn, the cooling-water passing through the condensers. The chlorinator is so designed that chlorine gas is only admitted and made to flow at pressures below atmospheric, thus obviating leakage, and is rated for a maximum capacity of 250-lb. of chlorine per hour, this providing some reserve above the average need indicated by preliminary tests. Chlorine gas is metered, and injected as a solution, by a master visible vacuum chlorinator, a high-capacity machine with very precise control equipment. Treatment is applied intermittently, and in turn, to the circulating water being delivered to each condenser.

*The central control room showing (on left) the unit control panels for the boilers and turbines.*

Four circulating-water pumps, each with a capacity of 20,000-gal./min. were supplied by Mather & Platt Ltd. These are of the vertical-spindle, centrifugal type, and they draw water from the cooling tower ponds, through a 54-in. dia. pipe, for discharge into the condenser inlet main through hydraulically-operated non-return valves. Three circulating-water make-up pumps, any two of which are sufficient to provide make-up when the station is operating at full load, were supplied by Gwynnes Pumps Ltd.

**Water treatment plant**

The water treatment plant installed by The Permutit Co. Ltd., has been designed to provide boiler feedwater at a normal rate of 4,300 gal./hr. or 84,000 gal./day. The plant consists of two starvation units, a degasser, with degassed water pumps; and two mixed-bed "Deminrolit" units. Of these, one starvation and one mixed-bed unit are for normal service, the remaining pair acting as standby. Raw water is fed first to the starvation unit, where it is partially treated before passing through the degasser to be collected in the degassed water sump. From here the water is pumped to the mixed-bed unit for final treatment, after which it is passed into service. The starvation process removes temporary hardness and alkaline salts (bicarbonates). Carbon-dioxide freed in the process is removed in the degasser, where the water falls through a counter-current of air in the degasser tower. Final treatment by the mixed-bed unit removes the remaining dissolved salts, carbon dioxide and silica.

Water for the cooling make-up system has a very high turbidity content due to effluent from coal-washing plants discharging into it, and a 130,000 gal./hr. capacity water treatment plant supplied by Candy Filters Ltd. has been installed for the chemical treatment of the river water followed by flocculation and settlement.

The Chemical Pumps Division of The Candy Filter Co. Ltd. (now Metering Pumps Limited), supplied the hydrazine dosing equipment. This plant comprises two Metripumps of the variable-output type, with pump heads in stainless steel, each capable of delivering up to 1.10-gal./hr. of solution at full-length stroke, when operating at the fastest of six available stroke speeds.

Treated water is delivered to six, 28-ft. dia. conical tanks, and passes to the base of the tanks where hydraulic flocculation takes place. As the water rises in the conical section the decreasing velocity enables the suspended matter to be retained, and a clarified water is decanted from a peripheral collecting weir at the top of the tanks. Accumulated sludge can either be bled from a 1-in. dia. bleed pipe, or taken intermittently from the 4-in. sludge discharge drains. It is then delivered to a concentrator and the thickened material pumped away for disposal. Decanted water from the concentrator is returned to the river.

# New 60-MW Power Station for N.C.B.

At the time of the nationalisation of the coal-mining industry, collieries in the No. 4 (Carlton) Area, now part of the North Eastern Division, National Coal Board, received electricity via 22-kV overhead lines, from a power station at Frickley Colliery. Shortly after vesting-date when consideration was given to additional generating plant, due regard was paid to the fact that the boilers at Frickley were fired with a valuable coking coal ; and in view of these circumstances it was decided that a new station should be built at Grimethorpe where there was a reserve of 24-million tons of Kent's Thick Seam coal which, due to its high ash content (25 per cent.), was considered unsaleable. It was also considered essential that the boilers of a new power station should be capable of burning, untreated fines and slurries. The Parolle Electrical Plant Co. Ltd. were appointed to advise the Board, and to prepare the necessary design. Authority for the building was given by the National Coal Board on March 13th, 1954, and the station, with an installed capacity of 60-MW, was recently completed, being officially opened on Saturday, September 20th, 1958, by Mr. W. H. Sales, chairman, North Eastern Division, National Coal Board.

The power station buildings comprise a boiler house, bunker bay, turbine house, switchgear and transformer bays, the overall measurements of which are 252-ft. long by 217-ft. wide. The foundations are of reinforced-concrete supported on 1,020 pre-cast reinforced-concrete piles of 12-in. × 12-in. section, and an average length of 20-ft. The superstructure is of reinforced-concrete, the main framing members being pre-cast and clad throughout in brickwork. The boiler house is 67-ft. wide by 90-ft. high with a pre-cast reinforced-concrete shell-type roof finished with vermiculite screed and felting, and supported by pre-stressed pre-cast reinforced-concrete valley beams. The bunker bay is 22-ft. wide by 90-ft. high, accommodating five cast *in-situ* reinforced-concrete bunkers, each having a capacity of about 200-tons and providing a 24-hr. storage per boiler unit at continuous maximum rating. To facilitate discharge, the bunker hoppers are lined with glass. The turbine house is 58-ft. wide by 57-ft. high with a similar type of roof construction to that of the boiler house, and is provided with a 60-ton overhead travelling crane supported on a pre-cast reinforced-concrete gantry. The main contractors for the civil engineering and buildings were J. Miller & Partners Ltd., while the single reinforced-concrete chimney provided to serve the boiler plant was erected by Holst & Co. Ltd. The chimney is 300-ft. high by 25-ft. dia. at base, and 17-ft. 9-in. dia. at the top, being lined throughout with acid-resisting insulating brickwork. A reinforced-concrete hyperbolic, natural-draught, cooling tower, 170-ft. dia. at the base and 264-ft. high, was built by Davenport Engineering Co. Ltd. The tower basement, which is 14-ft. deep, and has a storage capacity of 2-million gal., is bifurcated to allow one-half to be maintained or cleaned while the other half remains in service. Between the cooling tower and the power station, the circulating-water supply system consists of four 48-in. dia. pre-stressed pre-cast reinforced-concrete pipes, two connected to each half of the tower. Within the turbine house, these pipes are connected to reinforced-concrete culverts comprising two inlet and two outlet sections.

**Coal-handling plant**

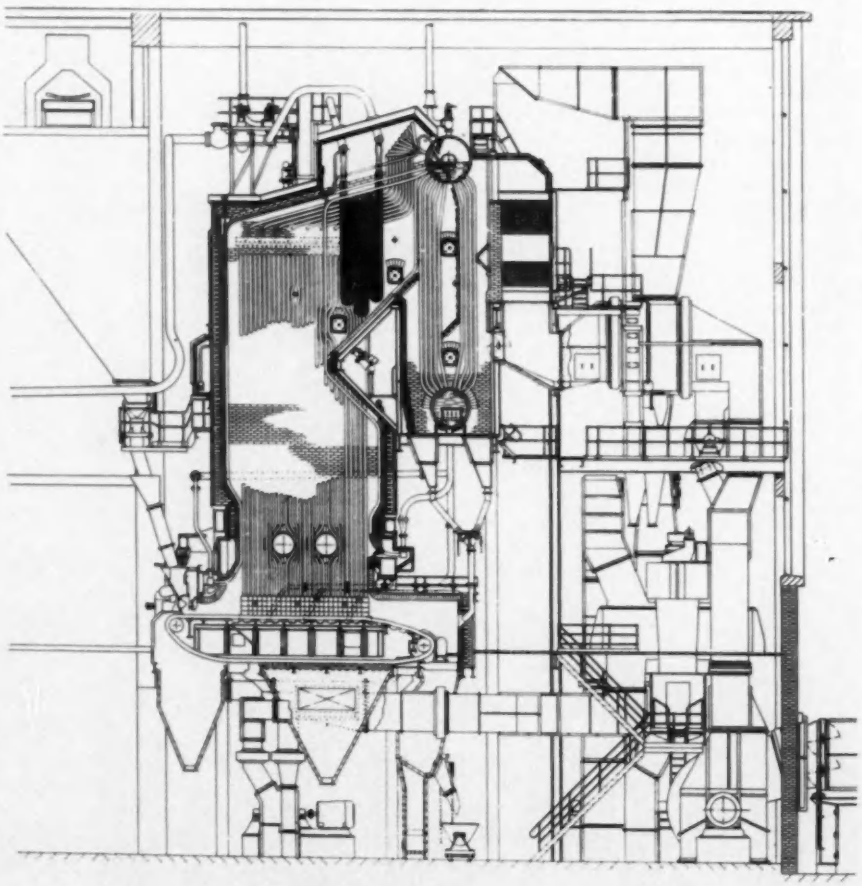
The coal-handling plant was supplied by Simon-Carves Ltd., and forms part of a comprehensive scheme whereby the Kent's Thick Seam coal, which is brought to the surface during the night shift, is reduced in size to 8-in. and conveyed to the 5,600-ton capacity coal storage area. The capacity of the preliminary coal-breaking and outstocking section of the plant is 400-tons/hr. Coal from other collieries may be imported in self-tipping motor lorries or in railway wagons, for which a wagon-tippler is provided. Coal is reclaimed from the storage area and passed to an underground conveyor via hoppers, from where it is taken to a transfer tower ; here a crusher (complete with pre-screen) reduces the coal to a maximum size of 1-in. The transfer tower is also equipped with a slurry-mixing plant which can handle slurry, filter cake and fines. The slurry and fines are fed into a feeder by means of a grab and are

*A general view of the recently completed 60-MW capacity Grimethorpe power station of the N.C.B. looking from the east.*

intermixed with the raw Kent's Thick Seam coal. The combined fuel is then conveyed and distributed to the overhead coal-bunkers in the boiler house.

**Boiler plant**

The steam generating plant comprises five units, each with a c.m.r. of 150,000 lb./hr. at 425 lb./sq. in. and 820 deg. F. at the boiler outlet, from feedwater entering the economiser at 270 deg. F. They are also required to produce for short periods an overload output of 175,000 lb./hr., these conditions being obtainable when fired with Kent's Thick Seam run-of-mine coal, which as stated has an ash content of 25 per cent. The boiler furnaces are also required to be capable of burning a mixture of Kent's coal with coke breeze, jigged or frothed flotation fines, filter cake or slurry. Provision has also been made on two of the units for the installation of coke-oven gas burners, to burn excess gas should this become available. The boilers were designed and constructed by Clarke, Chapman & Co. Ltd., and are of the bi-drum radiant-heat natural-circulation water-tube type, fired by travelling-grate stokers supplied by International Combustion Products Ltd. The walls of the combustion chamber are cooled by 3¼-in. o/d tubes at nominal pitches of 6½-in. backed by refractory walls and insulating blocks, the whole boiler being enclosed in steel casings. The rear-wall tubes are arched inwards to provide a " nose " to protect the pendant section of the superheater from the direct radiation of the combustion zone. The gases leave the boiler and travel downwards through the economiser, leaving at a temperature of 470 deg. F., and then passing through dust-extraction plant of the mechanical type manufactured by Davidson & Co. Ltd. The cleaned gases are then delivered to a Ljungström rotary air-preheater supplied by James Howden and Co. Ltd., having a heating surface of 22,000 sq. ft. designed to raise the temperature of air required for combustion from 90 to 273 deg. F., whilst the gas temperature is reduced to 319 deg. F. The gases then pass to the induced-draught fan and thence to a common flue leading to the single chimney. Feedwater at a temperature of 270 deg. F. enters the economiser, supplied by Senior Economisers Ltd., and is raised to 370 deg. F. The economiser is of welded construction, having cast-iron sleeves shrunk on to the tubes to provide additional heat-absorbing surface. The water is then fed into the boiler top drum and distributed along its length by an internal pipe. It then flows down, through the rear bank of circulating tubes into the bottom drum, where the greater part of water is taken through large bore downcomer pipes to four headers at the bottom of the combustion chamber walls. The flow then continues up the tubes forming these walls, to the top drum where steam separation takes place, this process being induced by a system of baffles, before the steam passes through scrubbers into the superheater. The saturated steam leaves the top drum through a row of superheater tubes which are pitched between the boiler tubes forming the front wall and roof of the combustion chamber. These tubes which extend across the central part of the wall are taken down about half the height of the wall and are connected to a header. The steam is returned through more tubes pitched between the boiler tubes and occupying the outer sections of the front wall. These tubes form the radiant section of the superheater. The return tubes are connected



*Arrangement of one of the five boilers, each with a capacity of 150,000 lb./hr. at 425 lb./sq. in. and 820 deg. F. supplied by Clarke, Chapman & Co. Ltd.*

to the end sections of the header at the front of the pendant superheater, and the steam flows through the primary wing elements to the rear header where it is then piped to two desuperheaters fitted into the bottom drum, which are arranged with a system of remotely controlled by-pass valves for the automatic regulation of the final steam temperature. The draught plant for each unit comprises a forced-draught fan, induced-draught fan and secondary-air fan, manufactured by

*View along firing aisle showing fronts of the five Clarke, Chapman 150,000 lb./hr. boilers.*

James Howden and Co. Ltd. The f.d. fan capacity at c.m.r. is 58,000 cu. ft./min. against a static head of 4.5 in. w.g. Outlet control is achieved with moveable vanes in the fan inlet. The i.d. fan is of similar design to the f.d. unit, but with a capacity at c.m.r. of 96,000 cu. ft./min. against a static head of 5.4 in. w.g. at a temperature of 290 deg. F., the method of control being as for the f.d. fan. The secondary-air fan control is again similar to that for the f.d. and i.d. units, the capacity of the fan at c.m.r. being 15,200 cu. ft./min. against a static head of 11 in. w.g. at 270 deg. F. The normal boiler operating instrumentation is fitted, and automatic combustion control is included, together with a master control for the five units. The soot-blowing equipment supplied by Hopkinsons Ltd. comprises ten electrically-operated units per boiler, designed for automatic sequence and/or selective operation from the sootblower control panel. The blower units are arranged to clean the combustion chamber walls, roof, pendent superheater and boiler circulating tubes. Hand-operated soot-blowers are fitted on the air-preheater. The mountings and fittings are of Hopkinsons' manufacture, the main instruments and control panels by Elliott Bros. Ltd., the control equipment by George Kent Ltd., and three-element feedwater regulating equipment by Copes Regulators Ltd.

**Ash and dust-handling plant**

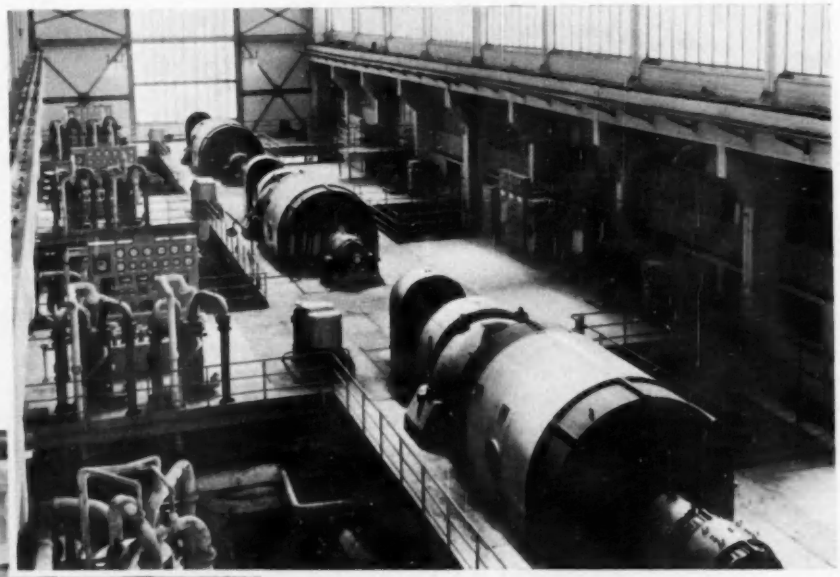
The ash and dust-handling plant, supplied by Holdan Engineers (London) Ltd., is arranged so that ash from the rear of the stokers is continuously discharged through air-tight cast-iron chutes into a low-velocity gravity sluice-way. Fine ash from the riddlings hoppers below the stokers is discharged intermittently through gravity chutes into branch sluiceways. The ash is sluiced to a grabbing-sump having a capacity of 160-tons, from which it is handled by a monorail telpher having a duty cycle enabling ash to be reclaimed at the rate of 40-tons per hour. The ash can be discharged directly into rail wagons, or alternatively, on to a draining apron to allow further de-watering. The main dust-handling plant removes grit from four collection points on each boiler, to two 50-ton storage containers which discharge wetted dust through twin-screw mixers to rail wagons. The plant is of the high-vacuum type, using comparatively small pipelines, and the capacity is such that the entire daily make of grit from the station can be handled in two periods of approximately 2½-hr. each. The operating vacuum is provided by exhausters of the Roots type. The plant is of particular interest in that high efficiency ceramic filters are used for dust separation in the containers, which are also fitted with aeration discharge floors to ensure free discharge conditions. The plant is of the fully-automatic sequence-controlled type, whereby the dust-handling operation is initiated by pressing a single starting button, and the system then proceeds automatically through the complete range of boilers. The automatic system is further extended to provide indication of main container storage conditions and to effect automatic change-over from one container to another with completely interlocked protection of all container discharging equipment. This is believed to be the first plant of this nature in actual operation in this country to which automatic operation has been applied so comprehensively. A separate, small, station surface-cleaning plant fitted with approximately 60 outlet points is also installed for general station cleaning and also for the removal of bulk dust from the main flue.

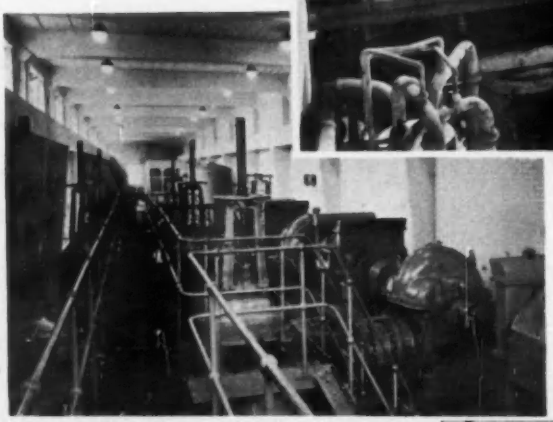
The turbo-alternator plant comprises three units, supplied and installed by C. A. Parsons & Co. Ltd., each having a maximum rating or 20-MW and an economical rating of 16-MW. The turbines are single-cylinder machines, fitted throughout with reaction blading, the blading material being of stainless iron. They are designed to operate with steam at a pressure of 400 lb./sq. in. and a temperature of 800 deg. F. A separate steam-chest containing one runaway stop-valve and two governor-valves is mounted alongside the turbine. Three stages of feed-heating are employed, heating the condensate to a final temperature of 290 deg. F. at economical load. A single-shell, triple-flow condenser deals with the exhaust steam and has a cooling surface of 25,000 sq. ft. Duplicate full-capacity two-stage air-ejectors maintain the exhaust vacuum, whilst two full-capacity vertical single-stage extraction pumps deal with the condensate.

The water system associated with the Grimethorpe installation is divided into two parts, viz., circulating-water for cooling purposes ; and boiler feed-water make-up. To ensure adequate storage, two existing reservoirs are used, one to hold water for cooling purposes, and the other raw water boiler feed make-up. Cooling-water is taken from the River Dearne, and delivered, by means of two automatically-operated, vertical spindle pumps, supplied by Sulzer Bros. Ltd., each with a capacity of 1,000 gal./min., via a 12-in. main to the cooling water reservoir, which holds approx. 1½-million gal. From here it is pumped to the water treatment plant where it is passed through pressure filters. The water is then dosed with sulphuric acid, degassed, causticised and passed to the cooling-tower pond. The single cooling-tower can deal with a total quantity of 2,540,000 gal./hr. and is designed to cool this amount from 94 deg. F. to 75 deg. F. at a wet-bulb temperature of 52 deg. F. The boiler-feed reservoir has a capacity of approx. 1-million gal., and water is pumped to the treatment plant where it undergoes lime-soda treatment, is then filtered through pressure filters, and subsequently treated by a fully-automatic base-exchange plant supplied by Permutit Ltd. The boiler feed pumps were supplied by Mather & Platt Ltd.

The direct-coupled alternators associated with the turbines were also supplied by C. A. Parsons Ltd., and are rated at 20-MW, generating at 11,800 volts, 0.75 p.f. when driven at a speed of 3,000 r.p.m. They are air-cooled, employing a close-circuit system of ventilation. Each exciter unit is directly driven from the generator rotor at 3,000 r.p.m. and is ventilated from the generator main air circuit. The main and auxiliary switch-gear was supplied by A. Reyrolle & Co. Ltd.

At this present stage in the reconstruction programme of the area, the Grimethorpe colliery retains steam winding engines, and in order to maintain this steam supply





*(Above). Circulating-water pumps, also showing in distance the water treatment plant.*

*(Above right). The three 20-MW turbo-alternator sets which were supplied by C. A. Parsons & Co. Ltd.*

*(Right). View in station main control room, which includes station metering board, alternator voltage regulator panels, etc.*

(until such time as electrical winders are installed) a small back-pressure type turbo-alternator is installed. This was supplied by W. H. Allen Sons & Co. Ltd., and is rated at 1,250/1,325-kW, taking high-pressure steam at 400 lb./sq. in., 800 deg. F. and exhausting at 150 lb./sq. in., 630 deg. F. To implement the steam provided by this machine and also to act as a complete standby, during times of machine overhaul, a pressure-reducing valve is installed in parallel with the back-pressure turbo-alternator. The low-pressure steam is then desuperheated to 500 deg. F. and is available to the colliery winding engines via a steam accumulator system which was installed to cater for the high peaks demanded by the winding engines.

## A BOILER EFFICIENCY COMPUTER

Computing equipment built by Elliott Brothers (London) Ltd., designed to determine the efficiency of boiler installations, and arranged to accept the values of the plant variables transmitted from the site over Post Office lines, was demonstrated at the recent Industrial Fuel Efficiency Exhibition, and showed, very effectively, how such equipment installed at a central office could be connected to remote sites, and provide the required efficiency calculations automatically and continuously. The efficiency of the boiler installation under investigation and in connection with which information was transmitted to equipment on the stand of the National Industrial Fuel Efficiency Service was derived from the equation :

$$\pi = \frac{H_s - H_w}{H_f}$$

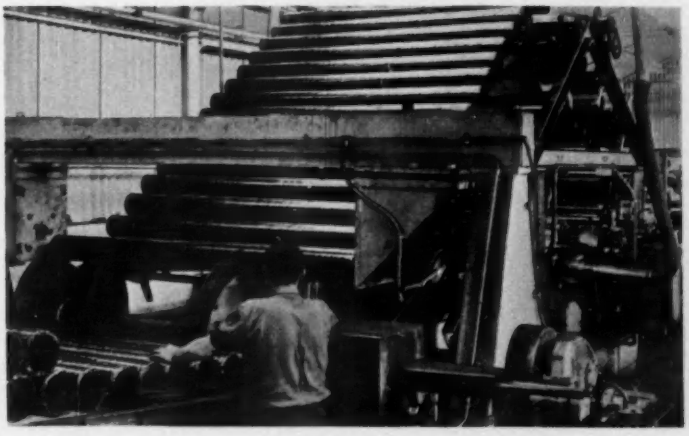
where $H_s$ = Heat in steam generated
$H_w$ = Heat in feedwater supplied
$H_f$ = Heat in fuel supplied

these terms being integrated values taken over a period which, for the purpose of the demonstration, had been chosen as 15 min. The calculation for the numerator of the above expression had been reduced to a mathematical operation requiring the following measured data :—steam temperature and pressure, the pressure differential across an orifice plate in the steam flow line, and feedwater temperature. (The first three are necessary because the system may be required to measure steam heat under widely differing conditions of temperature and pressure from plant to plant.) These factors were measured on site and telemetered by Post Office land line using Bristol Instrument Co. Ltd. " Metameter " transmitters and receivers. In addition to their normal operating circuits, the receivers had been fitted with potentiometer " pick-offs " from which voltage outputs were derived whose amplitudes were proportional to the values of the process variables. To enable the equipment to deal accurately with rapidly varying boiler conditions, these outputs were sampled every 15 sec. The actual calculation of $(H_s - H_w)$ was performed by an analogue computer which uses modified Elliott-Swartwout receivers together with a number of special amplifiers. The result, which initially appears as an analogue voltage, is converted by an analogue-to-digital device into decimal form, each decade of which is represented by a set voltage appearing on one of ten wires. Finally this number is passed to an accumulating store where it is added to the previous stored value.

Simultaneously with the above operation, the quantity of fuel being used was also telemetered from the boiler plant (again with " Metameter " equipment). The received values were taken every 15 sec. and passed to a further accumulating store. At the end of the integration period when the efficiency was to be calculated, the total in the store was converted to its heat equivalent by multiplying by calorific value (in the case of liquid fuels, by a factor involving oil temperature). The period for which the readings are integrated is timed by means of a digital clock included in the equipment. For demonstration purposes this was set for 15 min. At the end of a 15 min. cycle the calculation and storage circuits for steam and fuel heats were automatically disconnected from their input circuits. The contents of the stores were then sampled and a further computing circuit calculated the efficiency (from the equation above). Final results were printed out in tabular form by a teleprinter. In the equipment shown it was possible for the values of the primary variables also to be printed out, together with the times supplied but, for demonstration purposes, " spot " readings at the end of each 15 min. period were used. The log sheet appeared as :—steam flow (lb./hr.) ; steam pressure (lb./sq. in.) ; steam temperature (deg. F.) ; water flow (lb./hr.) ; water temperature (deg. F.) ; fuel (lb./hr.) ; calorific value (B.Th.U./lb.) ; and efficiency (per cent.). When printing has been completed the stores are re-set to zero ready to receive the next cycle of heat integration.

## PITCH FIBRE PIPE MANUFACTURE

Extensions have recently been completed at the Larkfield works of Key Engineering Co. Ltd., near Maidstone, Kent, in order to meet increasing demands for the company's range of pitch-impregnated fibre pipes, which are used extensively as electrical conduit, and for drainage purposes. Straight pipes are manufactured in lengths of 8-ft. or 5-ft. 6-in., with internal diameters of up to 6-in., and a range of pipe bends, junctions and angled couplings are also available, together with saddles and adaptors for jointing fibre pipe into other types of drainpipe. The pipes are manufactured from a pulp comprised of a mixture of carefully selected cellulose fibres which is fed from the preparation plant on to a moving sheet of fine felt which transfers it to a revolving mandrel. As the mandrel revolves, it gathers the mixture from the felt and builds up the wall thickness of the pipe to the required degree. The wet fibre pipes are then conveyed automatically to drying ovens, through which they travel on slow-moving conveyors until baked into a hard, tough condition. At the end of this process the mandrel is automatically ejected, leaving a smooth-bored dry white pipe of felted fibrous structure. Batches of these pipes are then transferred to the impregnation section where they are subjected to alternate vacuum and pressure impregnation cycles, with pitch maintained at a pre-set temperature. During this passage through the impregnation tanks, the pitch soaks right through the wall of the pipe to make a homogeneous structure of considerable strength. The pipes are next taken to the machine shop where a 2° taper is machined at each end by accurately-controlled automatic lathes. To match the increased output of the factory, a special conveyor system, which will carry the finished pipes to the stockyard for distribution and stacking by fork lift truck, is under construction.



*Automatic lathes are used for tapering the ends for collar coupling joints on Key fibre pipes.*

# Hinkley Point

## Ten months' constructional progress

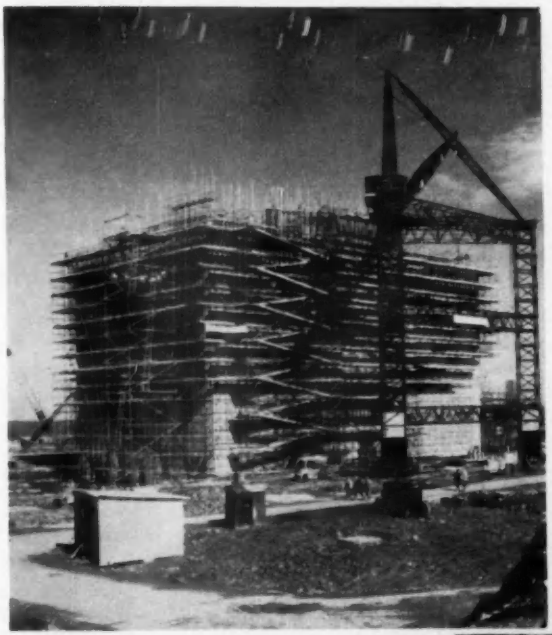
*When this £60 million nuclear power station is completed in 1962 with an output capacity of 500-MW, it will, it is estimated, be the first in the world to generate electricity at a cost equal to, or even lower than the average cost of electricity produced in conventional stations. The two reactors will be the largest in the world, and will contain 375 tons of uranium. The twelve associated heat-exchangers will together produce 5½ million lb./hr. of steam. The gross equivalent electrical output from the two reactors will be 660-MW; but of this amount, 160-MW will be required for driving the auxiliary plant within the station.*

DURING a recent visit to Hinkley Point we were able to see the extent of the very considerable amount of progress which has been made with civil engineering and constructional work since the commencement of such work in December, 1957. The station being built for the Central Electricity Generating Board by the English Electric—Babcock & Wilcox—Taylor Woodrow Atomic Power group is the fourth, and latest, of the nuclear power stations to be ordered under the British nuclear power programme. It is thought to be the largest nuclear power installation being built anywhere in the world at the present time. Furthermore, it is expected to generate electricity at a lower cost than any other nuclear station under construction; the expected cost being less than 0.65d. per unit sent out, which is less than the national average cost of generation in Great Britain today. The net electrical output of 500-MW from the reactors will be something like 60 per cent. more than is expected from other natural uranium, gas-cooled, graphite-moderated reactors of comparable size, now under construction in the United Kingdom. When the station is completed in 1962, the two reactors will be associated with twelve steam-raising units providing a total steam production capacity of 5½-million lb./hr. which will be supplied to six main turbo-alternators each of 93.5-MW rating, and to three variable-speed turbo-alternators for supplying power for driving the gas-circulator blowers.

The initial task on the station site involved the removal of approx. 200,000 cu. yd. of soil and clay excavation to form the general station level at + 36.00-ft. O.D. By use of fast-moving scraper equipment, this was practically completed by early January, enabling the excavation in rock for the reactor foundations to start that month. Some 32,000 cu. yd. of rock excavation have been taken out for the foundations of reactors Nos. 1 and 2, as well as deep excavations for the blower house. By the beginning of October, approximately 900 tons of steel for reinforcement had been used in the foundations and walls of reactor No. 1, and some 22,100 cu. yd. of high-quality concrete placed in the shield and foundations. On this reactor, the main biological shield construction was about 85 per cent. complete, and the secondary shield approximately 60 per cent. complete. Concreting in reactor No. 2 foundation started late in June and some 4,700 cu. yd. have been placed to date. The reinforced-concrete subway for conveying the high-voltage cables from the turbine house to the 275-kV switchgear compound, south of the main station site, is approximately 80 per cent. complete. Some 2,200 cu. yd. of concrete have been placed for the foundations of the 250-ft. gauge track to carry the 240-ft. high Goliath crane, which is being supplied by Babcock & Wilcox Ltd., and which will be capable of lifting 400-tons. Erection of this giant crane is due to begin shortly. To enable the construction of the turbine house and cooling-water system with its associated pumphouse and tunnels to be commenced, work on a 3,500-ft. long seawall has been completed, some 21,000 cu. yd. of concrete having been placed in tidal working conditions; 70,000 sq. yd. of foreshore having been reclaimed in forming the sea defence. An 18-ft. dia. access shaft for the intake tunnels has

*Panoramic view of site looking west from top of No. 1 reactor. In the centre are the foundations for No. 2 reactor, while in the background can be seen the site for the pressure vessel assembly building, and beyond that the building for fabricating the steam raising units.*

been sunk to a depth of approximately 100-ft., and lined with cast-iron segments, and work is now proceeding on driving an access tunnel and cross-headings to the water tunnels. Approximately 3,000 cu. yd. of rock have been excavated. Rock excavation for the turbine house and associated cooling-water culverts, started in May, is now nearly completed, some 80,000 cu. yd. having been removed, 2,300 cu. yd. of concrete being placed in the turbine house and 1,800 cu. yd. in the culverts. A temporary dry-dock, in which the cooling-water intake structure caisson will be built, and from which it will later be floated to its final position, some 600-yd. of the foreshore, is now completed. Excavations to form the dock totalled 21,000 cu. yd. of rock. To provide facilities for off-loading heavy plant and equipment brought by sea from the works in Scotland and the North of England, a wharf, or rather what is virtually a new port, has been constructed at Combwich, four miles from the site, and this is capable of handling ships of up to 1,500 tons. Erection of the 45-ton crane is complete, and foundations are ready to receive the 150-ton crane for off-loading exceptionally heavy loads such as turbo-alternators, transformers, etc.

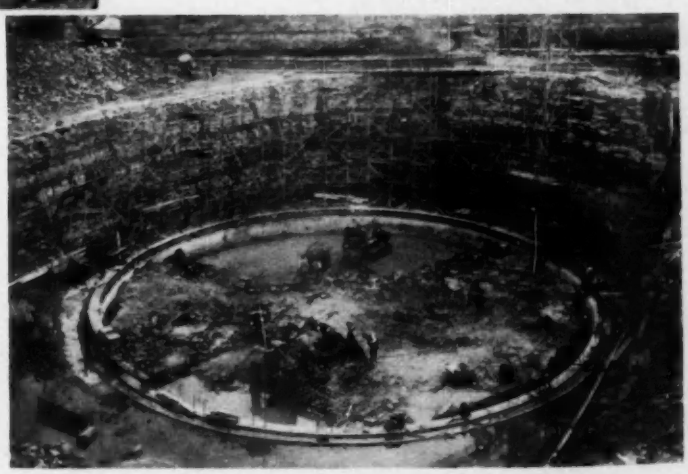


*(Above): Recent view of No. 1 reactor building in which the biological shield has now almost been completed to its full height of 100 ft. The completed reactor building will be 180 ft. high.*

**Outbuildings and off-site works**

Temporary works have been prepared for Babcock & Wilcox Ltd., to carry out site fabrication work on pressure vessels, steam-raising units and associated pipework. An area 215-ft. by 200-ft. with a 12-in. thick concrete floor has been laid to form the pressure-vessel erection area, whilst another area 227-ft. by 100-ft. has been laid for hydraulically testing the steam-raising units. A large Arcon type building, covering an area of 168-ft. by 138-ft., has been erected for fabricating the steam-raising units, and another Arcon building 218-ft. by 67-ft. has been built for shot-blasting purposes (i.e., cleaning all tubes and elements which go into the steam-raising units). In addition, stores, workshops, garages, and a boiler house have been constructed, and in the fabrication shop, welding tests can be carried out. The English Electric Co.'s stores and workshop building is now in its final stage of construction and will be ready for occupation almost immediately. Although at the moment the interest is largely of a civil engineering nature, it will be appreciated that concurrently there is a considerable amount of constructional work proceeding at the works of the member companies, the results of which will become increasingly apparent on site in the near future. For example, the steam-raising unit shell sections are now in course of fabrication, at the Renfrew works of Babcock & Wilcox Ltd., where also many of the 3-in. plates for the reactor pressure-vessels have been formed, and the first courses are in an advanced stage of fabrication for the ultimate site construction of the vessels. At the group's headquarters at Whetstone, a separate workshop for the machining of the graphite has been erected, ready for full operation early next year. At the same time, construction of the turbo-alternator plant will be commenced.

Comprehensive information regarding the design of Hinkley Point power station was contained in a Paper presented at the "Atoms for Peace" conference at



*(Right): In the 60 ft. deep dry dock area, the cooling water intake caisson is being built before being floated 2,000 ft. out to sea and sunk into position.*

Geneva in September last, by Dr. H. S. Arms, Mr. C. Bottrell and Mr. P. H. W. Wolff, chief engineer, chief power station engineer, and chief reactor engineer, respectively, of the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group. The following information includes abstracts from the Paper.

**The station layout**

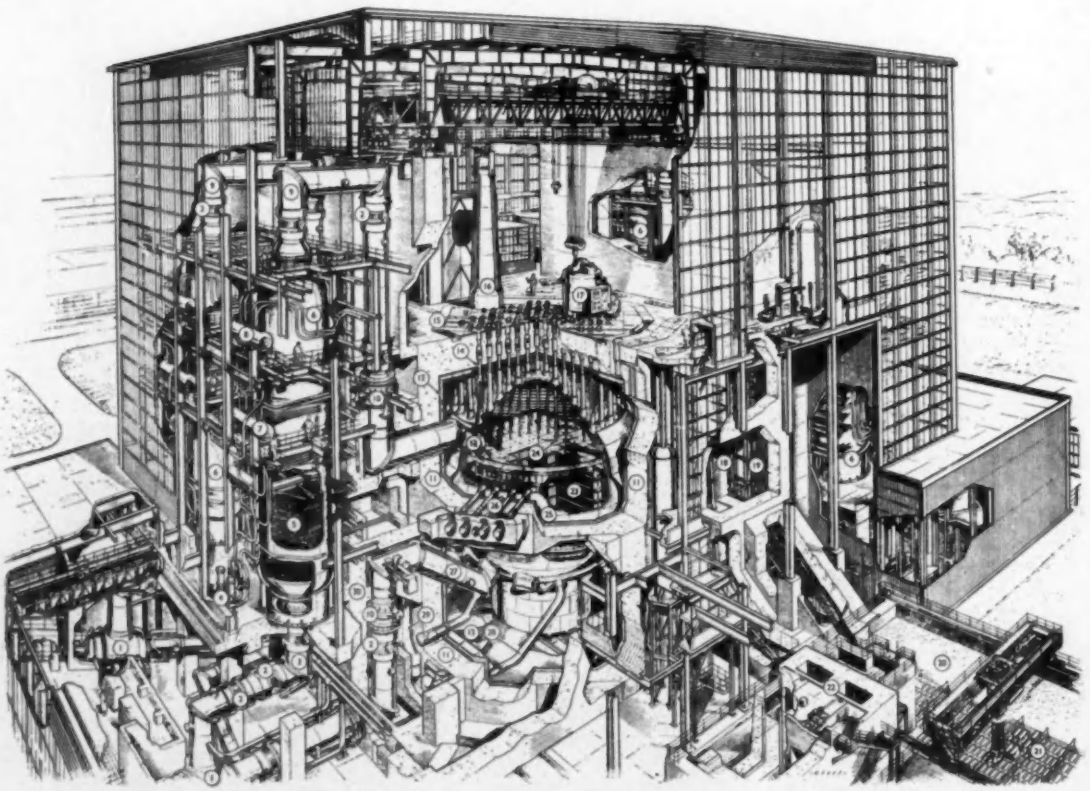
The station layout was determined basically from consideration of economy, ease of operation, ease of control, safety, and ease of construction. The turbine house is being constructed nearly parallel with the sea wall, and parallel with the line connecting the centres of the two reactors which will be on the landward side of the site. This disposition requires the minimum length and expense for the cooling-water culverts, though it does require a fairly long run of cable to reach the switch-gear site behind the reactors.

The arrangement of the reactor buildings, each with three heat-exchangers and associated blower houses on either side, and their orientation with respect to the turbine house was determined, partly from reasons of economy of pipe and cable runs, but largely by the decision to use the previously mentioned Goliath crane for erection of the heat-exchanger shells and the pressure-vessel sections.

The group of administration buildings at the eastern end of the turbine house were located to allow construction to begin from that end and to allow expansion of some of the buildings, as and when a second station is built to the east of the present one. The fuel cooling ponds, decontamination area, laundry, and effluent treatment plant are to be placed on the south side of the reactors to isolate these areas as much as possible from the rest of the site and to make the access for bringing in and removing fuel as direct as possible.

**The reactor building**

Three boilers (or heat-exchangers) and their associated ducting and carbon-dioxide blowers will be located on the east and west sides of each reator. On the north side of each reactor will be an auxiliary building housing the bulk of the equipment needed for $CO_2$ storage, vacuum systems, flux measurement, electrical supply, control-rod power supply, fuel-element failure detection, and shield cooling. The equipment on the south side of each reactor will include a test facility for the fuelling and hole preparation machines, discharge arrangements



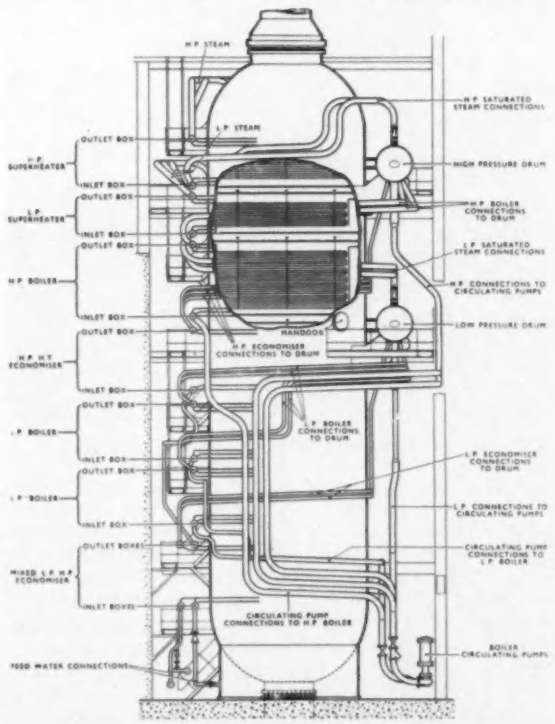
*Sectional view of one of the reactor buildings under construction at Hinkley Point nuclear power station.*

KEY: 1—Coolant-gas circulating blowers. 2—Hinged expansion bellows. 3—Coolant-gas outlet from steam-raising unit. 4—Steam-raising unit circulating pumps. 5—Stud-tube elements. 6—Steam-raising units (six per reactor). 7—Low-pressure steam drum. 8—High-pressure steam drum. 9—Coolant-gas inlet to steam-raising unit. 10—Coolant-gas including valves. 11—Main biological shield. 12—Coolant-gas outlet from reactor. 13—Thermal shield. 14—Charge tubes. 15—Charge floor. 16—Hole-preparation machine. 17—Charge and discharge machine. 18—Emergency discharge chute. 19—Spent fuel-element skip hoist. 20—Cooling pond. 21—Storage skips and grid. 22—Skip loading bays. 23—Graphite-moderator core. 24—Central rod. 25—Pressure-vessel. 26—Can-failure detection standpipes. 27—Coolant-gas inlet. 28—Debris-removal ducts. 29—Shield cooling-air ducting. 30—Secondary biological shield

for spent fuel and an access shaft to allow heavy equipment to be lowered from pile cap to ground level. At pile cap level the space is largely devoted to fuelling and servicing operations on the reactor. The 150-ton overhead travelling crane will be an integral part of the fuelling and servicing equipment. Each reactor building will be 175-ft. high by 345-ft. long by 185-ft. wide.

**The gas circuit**

The spherical pressure-vessels being constructed by Babcock & Wilcox Ltd. are of a boiler quality mild-steel suitable for site fabrication and relatively immune to radiation damage. By a combination of internal insulation of the top of the vessel, external insulation of the bottom of the vessel and carefully-designed air-cooling arrangements, it is possible to maintain the vessel temperature everywhere between the temperatures of about 600 deg. F. and 650 deg. F. These temperatures are low enough to avoid the necessity of lowering stress levels to cater for possible creep and high enough to




*A side elevation through one of the twelve steam-raising units. These will generate, in total, over 5.5 million pounds of steam per hour.*

make any radiation damage self-annealing. As a consequence, it is possible to increase the gas pressure to 185 lb./sq. in. g. so that high rates of heat extraction from the fuel become economical.

The pressure-vessels are designed with full-strength compensation on all major openings by forged T-section rings butt-welded on to the plating so that full X-ray inspection can be done. At the top of the vessel approximately 200 standpipes are provided, one for each group of 36 fuel channels plus extras to carry control rods and flux scanning gear. Each of these standpipes enters the vessel through a compensating nozzle.

One of the major improvements in the Hinkley Point reactor design has been the provision of an open Warren girder type of support structure to carry the graphite. This open structure passes the gas-flow from the bottom ducts to the fuel channels with the consequent possibility of raising the graphite volume in the sphere to about 40 per cent. of the whole volume of the sphere as compared with about 30 per cent. in previous designs. This support structure and the sphere itself are carried on a skirt ring, relatively shallow inside the vessel and longer outside. The junction between the skirt and the sphere is subject to elastic distortion caused by the increase of the sphere diameter under inflation pressure, and increase of skirt diameter under axial gravity loading, as well as steady and transient thermal gradients. Although this type of support looks very simple, it will be appreciated that it requires very careful design. The important joint between the skirt and sphere consists of a forged ring butt-welded on to the plating. Insulation and fairing plates guard the junction against excessive thermal gradients. Since the insulation inside the top of the vessel cannot be serviced once the reactor is active, it is of extremely robust construction, of stainless-steel sheet protected by $\frac{1}{4}$-in. mild steel plate on the gas side. Fortunately, the conductance needed, 2 B.Th.U./sq. ft. hr. per deg. F., is easy to obtain with a relatively thin pack.

The boilers (or heat exchangers) themselves are of the same general type as those constructed by Babcock & Wilcox Ltd. for Calder, but are of much improved design. In particular, the efficiency of space utilisation inside the shell is greatly improved by shaping the tube banks to fit closely to the shell and to the inspection passages. In addition, the detailed design of the studded tubes has given both greater heat transfer per foot run of tube, and lower pressure loss per unit of heat transfer. The design is also helped in this respect by the higher $CO_2$ pressure. The volumetric heat rating is about twice that achieved at Calder, and this, combined with an increase in diameter to 21-ft. 6-in. and in height to 90-ft., allows each boiler to handle over 160-MW of heat compared to about 50-MW each at Calder.

The method of construction of the boilers is the same as that, now well known, adopted at Calder Hall. Complete rings and domes, fabricated at the Babcock & Wilcox works at Renfrew, will be joined by circumferential welds in the special shop at site (to which we have already referred), to make the complete shell; and after hydraulic pressure testing will be placed in position and fitted (under rigorously clean conditions), with tubes, headers, drums and auxiliary equipment. The 21-ft. 6-in. dia. rings are too large for road or rail transport in Great Britain, so that they will be brought to site from Renfrew by sea, and via the Comwich wharf, previously referred to.

The design of the ducting end of the blowers is relatively straightforward. The 6-ft. 6-in. dia. ducts in any one circuit are arranged to be co-planar to avoid the need for gimballed expansion joints. These joints are 5-ft. 6-in. dia. internally joined to the ducts by venturi sections, as are the main gas valves of the butterfly type. The valves are located just outside the main biological shield and between the pressure-vessel and expansion joints to provide for maintenance.

The $CO_2$ circulators are to be single-stage axial-flow fans with overhung rotors operating at nearly 3,000 r.p.m.

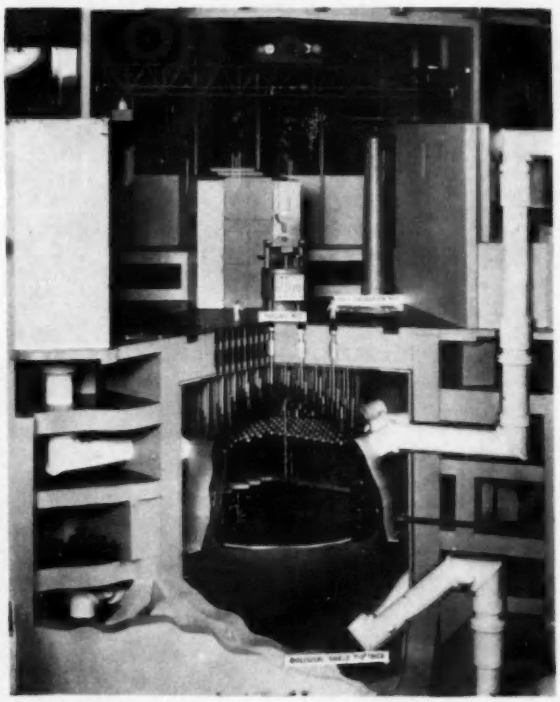
One special feature is the use of air-lubricated $CO_2$-packed shaft-seals. Because of the high pressure level, the rotor and stator casings are contained in a cylindrical pressure-vessel of about 13-ft. dia.

The method of blower drive is worthy of special mention. As the heat output of a gas-cooled reactor is varied, it is highly desirable to vary the gas flow in proportion. This will maintain all temperatures roughly at their full-load value and thus give best part load efficiency, at the same time facilitating rapid load changes and minimising trouble from varying temperature gradients through the fuel and the reactor core. Many methods of varying the gas-flow have been suggested, but only a few of these use well-tried equipment. Of the methods involving constant blower shaft speed, that of by-passing part of the flow back to the blower inlet is simplest and most reliable, but this shows worse part-load performance, than the better type of systems for varying the shaft speed. The power required by each blower is about 5,500 h.p. at design point, with 7,000 h.p. provided for either overload capability or to provide against a short-fall in performance or possible long term deterioration of the system. At this power, without using gearing, only direct steam-turbine drive or squirrel-cage induction motors appeared suitable. On the grounds of providing the smallest probable maintenance outage, the squirrel-cage motors were chosen and, since slipping couplings of proved reliability were not available for the power and speed required, variable frequency turbo-alternators were chosen to provide the power. Three of these are provided so that a maintenance standby is available. This scheme, though certainly not the cheapest, was selected as that involving the least technical uncertainty. The controlled speed range is from 750 to 3,000 r.p.m. so that stiff shafts are required for the motor, turbine and alternator, as well as an independent drive for the alternator cooling fans.

**The reactor core**

The principal features of the core follow the lines laid down in the Calder design. The graphite blocks, about 30-in. long, are located laterally by the double tile arrangement developed by the Atomic Energy Authority to provide for minimum Wigner growth in the vertical and two perpendicular horizontal directions. The general shape is a 24-sided prism, carried on ball bearings to cater for differential thermal expansion of the graphite and steel supporting structure. The tongue and groove keying system between bricks and tiles has been offset, however, to reduce gas leakage from the fuel channels, giving about a 2 per cent. gain in reactor output. An incidental advantage of this change is a reduction of the bursting force exerted by the leakage gas, so that the duty of the restraint garters is eased. These garters, of co-axial mild and stainless-steel tubes, follow the Calder design, but an additional swinging link which attaches the spring to the restraint beam makes the spring tensions automatically equalising and avoids distorting forces on the stack during tightening. Further, by the use of stops on the restraint beams limiting the movement of the swinging links, the system is so arranged that, if one of the 24 springs fails, the tension of the remaining 23 is transmitted through the appropriate beam. The fuel element contains a cylindrical heat-treated uranium rod in a helically-finned can, provided with a side support to limit bow which would otherwise take place. The elements are stacked in the channels, and are handled from above for charge and discharge.

In common with the other three commercial nuclear power stations at present being built in Great Britain, the Hinkley Point reactors will be refuelled while operating at full pressure and full load. The operation will be continuous rather than batchwise. The advantages of this system are obvious. Interest and amortisation charges alone on a 500-MW station will amount to something like £15,000 a day. The difficulties are perhaps not so obvious. The equipment provided is essentially four main machines, a crane for moving the various items on the pile cap, a " hole preparation " machine for handling shield plugs or other equipment normally found in a pressure vessel standpipe, a charge chute for carrying the fuel from the pile cap to the core and back, and a fuelling machine to place and remove the individual fuel elements.



*Cut-away view of scale model of one of the reactor buildings showing pressure vessel, core, charge floor and $CO_2$ inlet and outlet ducts.*

**The turbine house**

The turbine house will comprise a main hall 640-ft. long by 135-ft. wide and 90-ft. high, with a north annexe to house the main generator transformers, a south annexe to house the auxiliary switchgear, mechanical plant and tanks, and a workshop at the eastern end. The basement floor level will be some 30-ft. below ground level so that the condensers are housed in the basement, and the main operating floor will be at ground level.

The six main turbo-alternators, being constructed by the English Electric Co. Ltd., will each be of 93.5-MW

maximum capacity, and arranged transversely, three at each end of the main hall, with the three variable frequency sets of 33-MW maximum capacity arranged transversely in the centre of the hall. The boiler feed pumps and the dump condenser plant will also be located around the centre of the hall. A loading bay at each end will cater for plant erection and subsequent maintenance. Two overhead travelling-cranes will provide lifts of 150 tons for the main hoist and 25 tons for the auxiliary hoist of one, and 40 tons for the main hoist and 15 tons for the auxiliary hoist of the other. The building is of structural steel framing with lightweight cladding.

The main turbines will be of the impulse reaction type operating on a dual-pressure cycle. At design rating the steam conditions at the turbine stop valve are :—

| | *Pressure* | *Temperature* |
|---|---|---|
| H.P. .. .. .. | 615 lb./sq. in. g. | 680 deg. F. |
| L.P. .. .. .. | 150 lb./sq. in. g. | 655 deg. F. |
| Vacuum .. .. | 29-in. Hg. | |
| Final feed .. .. | — | 166 deg. F. |

The turbine design comprises a single h.p. cylinder and two double-flow l.p. cylinders solidly coupled in line, each double-flow cylinder exhausting into its own condenser. The l.p. steam is admitted through a mixing belt about two-thirds of the way down the h.p. cylinder. The temperature of the l.p. steam is such as to provide some measure of reheat. The h.p. and l.p. steam is led to the turbine through four separately anchored combined stop and emergency valves, two for each pressure. The mechanical governor will be driven from the h.p. shaft and to oil pressure relays to operate controls on the h.p. and l.p. throttle valves. The gear associated with the h.p. valves is used for synchronising and for load control, while the gear associated with the l.p. valves will control the pressure of the l.p. steam. Two emergency governors fitted to the turbine shaft are arranged to shut both h.p. and l.p. valves in the event of over speed. Vacuum and load-limiting devices are arranged to unload the turbine in the event of deterioration of either vacuum or boiler pressure. The main oil-pump which is driven from the end of the h.p. shaft furnishes oil both for the governor gear and lubrication. Auxiliary, emergency and jacking pumps will also be supplied.

The single l.p. feed-heater for each set, together with the drains cooler, will raise the condensate temperature to 166 deg. F. at design load. Automatic control is provided to prevent the feed temperature falling below 145 deg. F. during part-load running. Special feed-heating equipment will provide a temperature of about 180 deg. F. for use during Wigner release.

The main condensers are to be of the twin-shell surface type designed for a vacuum of 28-in. with a cooling-water temperature of 550 deg. F.

The main alternators will be hydrogen-cooled and designed for a normal output of 87-MW at 0.85 power factor, with 15 lb./sq. in. g. hydrogen pressure. At the maximum output of 93.5-MW at 0.85 power factor, the hydrogen pressure is raised to 25 lb./sq. in. g. Generation voltage will be 13.8-kV. The main and pilot exciters are gear driven from the main alternator shaft.

**Variable frequency sets**

A separate variable frequency set will be provided to furnish blower power to each of the reactors, with a spare set which can be connected to either reactor to provide standby capacity. Each set is designed for 33-MW maximum and 28-MW economic rating. The controlled frequency is from 12½-c/s to 50-c/s. The turbines will be of the two-cylinder impulse reaction type supplied with high-pressure steam only, exhausting directly to their condensers with no feed-heating; the condensate will be pumped through the feed-heater associated with the main sets. The governor and control gear for these sets is of particularly high accuracy. It contains an electrical sensing circuit combined with a hydraulically-operated servo system. The alternators are rated at 33-MW at 0.9 power factor at 3,000 r.p.m., and generate at 11-kV. The oil-pumps, alternator cooling fans and exciters will be separately driven.

**Electrical equipment**

Generator transformers will step up the voltage from 13.8-kV to 275-kV. The high-voltage cables leading to the switch yard are to be carried in a cable tunnel around the western end of the turbine house. Two station transformers of 275/11-kV will furnish the station auxiliary supplies. The 11-kV unit will provide power for the $CO_2$ blower motors during commissioning. All other motors on the station above 150 h.p. will be supplied with current at 3.3-kV furnished by further 11/3.3-kV auxiliary transformers. The 11-kV switchgear on the variable frequency supply to the blower motors will have a rupturing capacity of 750-MVA, having been successfully tested at this rating over a range of frequencies from 50-c/s down to 10-c/s. The 3.3-kV and 450-V switchgear for other supplies will be conventional. Emergency power from the station battery will be capable of handling all essential auxiliaries for a period of 20 min.

**Steam dumping plant**

The capacity of the steam-dumping plant for Hinkley Point is to be only 20 per cent. of the output of one reactor, as compared with 100 per cent. at Calder. Since Hinkley Point is not designed to operate as a plutonium producing plant the dump condensers will not be needed except for such services as providing a " sink " for shut-down heat, and on starting, to cover the periods when the turbines are not running.

**Boiler feed system**

The eight boiler feed pumps each of 1,100,000 lb./hr. capacity will be grouped around the centre of the turbine house, the pump drive being from 3.3-kV squirrel-cage induction motors. The same pumps provide both h.p. and l.p. feedwater, the l.p. water passing through throttle valves before reaching the boilers. The extreme simplicity of this system more than outweighs the small loss of power in the throttle valves. In addition to the main feed pumps, the system contains two small emergency pumps, mentioned before, to provide water to dissipate shut-down heat. Make-up water will be taken from the local town's water supply and treated in an Ion exchange system. A chemical dosing plant will also be provided.

**Reactor shielding**

The shielding of mass-concrete is divided into two sections, a monolithic main biological shield protected at duct and other openings by a thinner secondary shield. The thermal shield is of concrete as well, rather than of the more usual steel. The whole structure has been designed to comply with the most recent requirements

of the International Committee for Radiological Protection with a substantial safety margin. The shielding is cooled by a relatively simple system of air passages associated with the same air flows and equipment that provides the cooling-air for controlling the pressure-vessel temperature. The shield cooling-air, together with all the $CO_2$ which may be discharged from blow-down lines, relief valves, or leakage from fuelling machine connections, is to be filtered before being discharged at roof level.

## PACKAGED BOILERS FOR OIL REFINERY

The first of three packaged boilers to be manufactured and installed by John Thompson Water Tube Boiler Co., at the Whitegate establishment of the Irish Oil Refining Co., was delivered to the site on October 1st, 1958. The boilers which are arranged for outdoor operation are of the 65 S type, from the Thompson standard range, designed to provide a 4-hr. peak load of 34,500 lb./hr., with a m.c.r. of 32,000 lb./hr. at 150 lb./sq. in. and 450 deg. F., from feedwater at 250 deg. F. They are fitted with the company's uncontrolled superheaters, and economisers. Of two-drum design, the boilers incorporate a water-walled combustion chamber, followed by a drainable superheater and a single-pass of boiler convection heating surface. Boiler circulation is maintained by a heat-screened downcomer section and insulation and casings are designed for pressurisation. The units are completely shop-erected on an integral sub-frame designed to facilitate transportation. The economisers are of the plain steel tube type, enclosed in fully insulated pressurised casings. Water-washing of the economiser elements is accommodated in the design arrangements. The boilers are equipped with steam-atomising burners, supplied by Hamworthy Engineering Ltd., and designed for operation with refinery fuel-oil and gas in any proportion. The oil supply is bled from the refinery main, and the gross calorific value of the gas can vary between 500 and 1,500 B.Th.U./cu. ft. Boilers of this type can normally operate with forced-draught only, the necessary f.d. fans for the Whitegate installation being supplied by James Howden & Co. Ltd., and driven by steam turbines supplied by Hayward Tyler & Co. Ltd. The plant has been designed for 100 per cent. make-up, and the water-treatment plant, to be supplied by John Thompson-Kennicott Ltd., will comprise an alkalininator to remove the alkaline hardness and a scrubbing tower for the removal of $CO_2$. Caustic-soda conditioning, followed by a final ion-exchange section, provides water ready for de-aeration in a Thompson-Kennicott pressure-type de-aerator. Feedwater dosing equipment and boiler water conditioning plant are also to be supplied by John Thompson-Kennicott Ltd. Two 2-boiler steel chimneys, 100-ft. high, and with a diameter at the top of 5-ft., supplied by John Thompson (Dudley) Co., are to be erected in connection with the Whitegate installation, and space has been allocated for a fourth boiler, should this be required in the future.

Road transport of the first boiler from Wolverhampton to Liverpool for shipment to Dublin was undertaken by Pickfords Ltd. The overall weight of the load was 52-tons, and because of a height of 14-ft. 6-in., special routes were selected both in England and for the 180-mile road journey from Dublin to Whitegate, which stage of the journey was sub-contracted by C.I.E. (the equivalent of British Road Services) to the Electricity Supply Board (Ireland). Special lifting-beams employed when moving the boiler from ship to shore, or vice-versa, were designed and manufactured by John Thompson Water Tube Boilers Co., following consultations with stevedores of the shipping company concerned, Coast Lines Ltd. It is understood that the second boiler will leave the Wolverhampton works in December, and delivery of the final unit will take place early in 1959.

*The first of three packaged boilers manufactured by John Thompson Water Tube Boiler Co. Ltd., en route from the company's Wolverhampton works to Liverpool, for shipment to Dublin.*

**The Central Electricity Generating Board** are to make application to the Minister of Power, and to the Local Planning Authority, for consent to develop a site at Sizewell for their sixth nuclear power station. It was selected after an extensive survey in Suffolk, as the site most suitable for development for nuclear power generation at the present time. The site area is mainly heath and woodland on the coast two miles to the east of the town of Leiston, and about twenty-five miles north-east of Ipswich. The sub-soil is capable of supporting the weight of heavy reactors, and vast quantities of water required for cooling purposes can be taken from the deep water which is reasonably close inshore. The area is generally above flood level, and locally the coast line is stable. The proposed power station will have an output capacity of about 650-MW, and the site is capable of further development. The station would be connected to the 275-kV national grid system by transmission lines proceeding westward from the site. The three nuclear power stations already being constructed by the Board are, of course, those at Berkeley, Gloucestershire (275-MW); Bradwell, Essex (300-MW) and Hinkley Point, Somerset (500-MW). Preliminary works have been started for the construction of a fourth station at Trawsfynydd, Merionethshire (500-MW), and application has been made for consent to develop a site at Dungeness for the Board's fifth nuclear power station.

* * *

A 3-day course on Fuel Oil-Firing, arranged by the National Industrial Fuel Efficiency Service, is to be held on Tuesday, Wednesday and Thursday, January 13th, 14th and 15th, 1959, at the Reading Office of N.I.F.E.S., Ailsa House, Kings Road, Reading. The course has been designed to meet the needs of industrial plant engineers, heating engineers and supervisory staff responsible for oil-fired boiler plants. Similar oil-firing courses held previously have been attended by more than 650 students. The fee for the course, exclusive of hotel accommodation, will be six guineas. Application forms, and a course syllabus, may be obtained from the National Industrial Fuel Efficiency Service, 71, Grosvenor Street, London, W.1. (Tel.: Hyde Park 9706.)

**The Central Electricity Generating Board** have received the consent of the Minister of Power to the extension of Blyth power station by the addition of a new section to be known as Blyth 'B.' The installation will comprise generating plant having a capacity of approximately 1,200-MW, and four coal-fired boilers. The new plant is planned to be brought into commission in 1962.

# RECENT Equipment AND Accessories

**Automatic temperature scanning**

In many processes it is desirable or even essential to keep a check on a large number of temperature points, and for this purpose an automatic temperature scanning equipment (type-B.B.1) has been made available by Fielden Electronics Ltd. The unit is a development of the Fielden potentiometric scanning systems, and the temperature is indicated on a large dial approximately 2-ft. diam., and around the periphery of which are the point numbers, e.g. 1-50. A motorised scanning switch enables the equipment to examine each point in turn, and a clear perspex pointer, tipped black, indicates the number of the point under examination at any one time. The desired value for all points will not be the same, and with this equipment it is possible to have a different set point for each of the fifty variables. The value of the set point is shown by the position of a red pointer and this can be adjusted by a small potentiometer under the indicator bezel and in line with the temperature point number. The actual value of the temperature is shown by the position of a green pointer and the measuring circuit is potentiometric. Thermocouples are used as the detecting elements and the output voltage of the thermocouple is compared with a stable d.c. voltage by means of a self-balancing servo mechanism. All the thermocouple leads are terminated on a panel at the rear of the equipment and automatic cold junction compensation is incorporated. On a large plant certain of the temperature variations may have to be held to closer tolerance than others, and to operate under these conditions the equipment has three tolerance bands which can be adjusted to required values. In normal operation the equipment will scan the fifty points in sequence, the red pointer will balance to the desired value and the green pointer will balance to the actual value. If the difference between these pointers is more than the pre-fixed amount for that particular point, then the scanning switch will stop and the signal lamp corresponding to the particular tolerance band will be illuminated. The switch can be re-started either by bringing the temperature to within the pre-fixed tolerance band or by manually switching the scanner to the next point in the sequence. Manual over-ride is possible by means of a handle provided on the front panel of the instrument, and this enables any temperature point to be indicated at will without waiting for the scanner to reach that point in its normal sequence. Push buttons are also provided which will stop and start the scanning switch so that this can be arrested on a particular point for any desired length of time. (*Fielden Electronics Ltd., Wythenshawe, Manchester.*)

**Heat exchanger unit**

British Boiler Accessories Limited, in conjunction with their associates on the Continent, have developed an entirely new type of heat exchanger, the B.B.A. "Helitube," the design of which is of particular interest, as it is a complete break-away from the conventional hairpin and floating-head type unit. The outer casing consists of a fabricated steel jacket and the nest of tubes can be either copper, steel, aluminium or stainless steel.

*Fig. 1. The new B.B.A. "Helitube" heat-exchanger. (British Boiler Accessories, Ltd.)*

The "Helitube" surfaces consist of narrow tubes tightly coiled into a helical shape. High quality seamless tubes are used, and these are secured in the tube plates by means of a tight fitting ferrule which beds the tube into grooves in order to effect a perfect seal. If steel tubes are used they are welded into the tube plates. Both methods of fixing the tube ends ensure a dead tight seal and throughout their life there can be no movement of the tube ends. The tube plates are rigidly fixed in the tube jacket without the necessity for expansion plates or floating heads. Any vibration or expansion or contraction caused by high variations in temperature are taken up in the light spring action of the tubes, and no stress is put on them. High overall heat transfer is achieved since the tubes are of a small bore, normally not more than ½-in. diam., which ensures intimate contact with the heat transfer surfaces of all the liquid, and at the same time turbulence is maintained. The flow of the liquid in the jacket runs almost at right angles to the helical coils, and inwards and outwards over the surface of the tubes ensuring the greatest percentage of surface coverage. The B.B.A. "Helitube" is being manufactured at the works of T. H. & J. Daniels Ltd., the parent company of British Boiler Accessories Ltd. (*British Boiler Accessories Ltd., 62/3, Fenchurch Street, London, E.C.3.*)

**Tube cleaning equipment**

The range of Lagonda tube cleaning equipment now manufactured by Consolidated Pneumatic Tool Co. Ltd. includes three sizes of vane-type motors available to operate a variety of cutting heads for dealing with straight or curved tubes from ½-in. to 6-in. and above internal diameter. The smallest motors are those of the 600-series, designed specifically for use on small straight tubes having internal diameters from 0.495 to 1.820-in., and curved tubes with diameters of from 0.791 to 2.080-in. having a minimum radius of 6-in. The 1300-series motor has been produced for cleaning in the tube range of 1¾ to 3⅜-in. i.d., for both straight and curved tubes. For larger tubes of over 4¼-in. i.d., sleeves are fitted over the motors. The 1100-series constitutes a range of heavy-duty motors for dealing with straight tubes only in the size range of 2½ to 6-in. i.d. A wide selection of cutter heads and brushes is available. All cutter heads are, however, variations of straight and trackless cone cutters in which the spacing of the cutter teeth or blades is so arranged that any one tooth does not return to the same point in a tube in successive revolutions of the head,

thus preventing the formation of tooth design in the tube and ensuring an even finish. For straight tubes, the cutter heads are direct coupled to the shaft or the motor used, whilst to obtain flexibility in curved tubes, a universal joint is always used between the cleaner motor and the cutter. Thus, for hard deposits in very small, straight or curved tubes, a simple threaded cone cutter, used with a 600-series motor through a universal coupling or a flexible holder, is available, while other heads for use with this motor are the scraper heads, recommended for soft, gummy or oily deposits and expanding brushes which deal effectively with very light deposits. For use with the 1300 series motors, for such tasks as removing boiler scale and much other general work, a short surface swing-frame type head will generally be found sufficient. A further head, supplied for service with either the 1300 or 1100-series motor, is the H-2 head, which is of the pivoted-arm type and consists of four sets of rotary cutters carried on arms projecting from a common base. This type of head is particularly suited to cleaning heavy or uneven deposits in straight tubes and in larger curved tubes and pipes. (*Consolidated Pneumatic Tool Co. Ltd., 232, Dawes Road, London, S.W.6.*)

**Pressure-operated bunker level switch**

Londex Ltd. have sent us details of a new addition to their range of level controls. This is a pressure-operated bunker switch which is mounted into the side of a hopper in the vertical or near vertical plane. When the level of material reaches the switch the pressure exerted on the face pad is transmitted via a liquid in the main housing to the bellows-operated pressure switch. Snap action, silver contacts then operate, these being single-pole, double-throw, rated at 5-amps, 250-V a.c. supply, or 3-amps, 440-V a.c. supply. The switch comprises two main parts, a brass housing and a Londex pressure switch. The housing is filled with ethylene glycol which is retained on the outward face by a thick rubber diaphragm which carries a pressure pad. It is the pressure pad only which projects into the bunker. The pressure pad is usually manufactured from a tough plastic material and has proved particularly successful with coal, eliminating any danger from incendive sparking. For other materials, such as stone chippings, etc., an aluminium alloy pad is fitted. The inward face of the brass housing is connected to the pressure switch, which comprises a bellows chamber and a die-cast box containing the switching arrangements. (*Londex Ltd., Anerley Works, 207, Anerley Road, London, S.E.20.*)

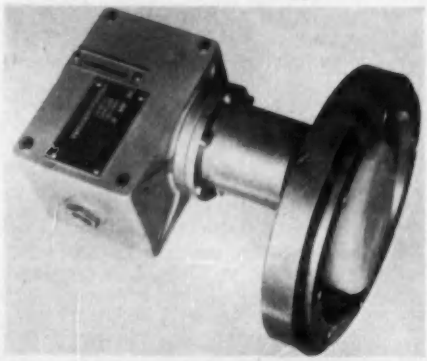


*Fig. 2. The new Londex pressure-operated bunker-level switch. (Londex Ltd.).*

**Tube expansion control system**

The Airetool Manufacturing Co. have recently re-designed the control box of their 113-15 tube expansion electric control system, making it more compact and also more efficient. A feature of the unit is that calibration determining the amount of expansion can be changed in a matter of seconds by merely adjusting the easy-to-read calibration dial, while in addition rolling time compared with similar methods is reduced because during the rolling operation the motor operates automatically. Tubes from ⅝ to 2½-in. i.d. may be rolled to maximum tightness with the Airetool control without inducing excessive cold worked stresses in the tube metal, without injuring tube ends or distorting the ligaments in the tube sheet. Use of the control also greatly extends the life of the tube expander. In operation, when the dial is set for the correct expansion, the control will maintain this expansion regardless of normal differences in tube sheet hole size or tube variation. The tube is rolled until metal-to-metal contact is made between the surface of the tube and tube sheet hole. Then the tube wall is subjected to sufficient compression to give a tight joint. The amount of tube wall reduction is a check on how tightly the tube is rolled. A minimum amount of expansion is required to ensure every joint being right as the control adjusts its operation to conform with the various factors, and maintains uniform tightness in each joint. Tube sheets are not enlarged or distorted. They will fit the shell without re-machining the diameter. Troublesome bowing of tubes, in fixed tube sheet heat exchangers, is greatly reduced. Airetool electric driving motors, in three different sizes to meet every tube expansion need, are specially designed for fast tube rolling, and an automatically operated control switch at the spindle end of the motor reduces manual motor controls to one conveniently operated starting switch. The spindle is equipped with interchangeable square drive sockets of various sizes to provide a flexible mandrel drive that helps reduce mandrel breakage. (*The Airetool Manufacturing Co., Springfield, Ohio, U.S.A.*)

**Flowmeters**

Fischer and Porter Ltd. announce the addition to their flowmeter range of two Purgerator meters, models 1115 and 1120, which are inexpensive, reduced accuracy indicating variable area flowmeters produced primarily for controlling the flow of gases and liquids at a constant rate for bubbler service applications and purging operations, as with corrosive service manometers. In addition they are used in conjunction with the company's constant differential-pressure regulator for measuring liquid level in an open tank. The meter body, which measures approximately 5-in. by 1½-in., is available with or without an integral stainless steel needle valve. The ¼-in. B.S.P.T. or N.P.T. threaded connection inserts may be either in brass or stainless steel. The metering tube may be scaled in any units of flow for 10 to 1 ranges, from 0.08 to 0.8 c.c./min. air, to 142 to 1,420 c.c./min. water, and 3,820 to 38,200 c.c./min. air. (*Fischer and Porter Ltd., Salterbeck Trading Estate, Workington, Cumberland.*)

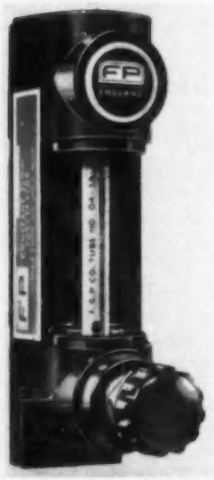


*Fig. 3. A model from the range of Purgerator flowmeters. (Fischer & Porter Ltd.)*

**New type automatic dust-collector**

The manufacturing rights of a new type of automatic dust-collector have been acquired by Visco Engineering Co. Ltd., Stafford Road, Croydon, Surrey, and this is now to be made available in addition to the company's "Visco-Beth" unit which is already well-known as a means of recovering powders such as chemicals, pharmaceuticals, oxides, etc., which have a saleable value. The new plant, known as the "Bermax" has been designed for high-temperature conditions, and is claimed to be particularly suitable for the recovery of dusts of no commercial value—e.g., the dust from arc furnace fume, desiliconising processes, colliery tipplers, foundry knock-outs and from boiler flue, cement clinker kiln, calcined alumina furnace gases, etc. The collector comprises a heavy-gauge sheet-steel casing, hopper, and common inlet expansion chamber constructed in flanged panel formation, the casing and hopper being divided into compartments according to capacity. Each compartment houses a spring-mounted filter-bed consisting of a primary cell filled with steel shavings and a secondary cell filled with stone chippings, graded according to the dust loading and particle size of the material handled. Each filter bed is connected directly to a shaker motor which is mounted externally on one side of each compartment of the collector casing. The hopper is fitted with a spiral conveyor, driven by a geared motor, and a rotary air lock dust discharge valve. An isolating damper to each compartment is fitted in the taper outlet on top of the collector, all the compartments being connected to the common cleaned air/gas exhaust header. Each damper is operated by a compressed-air cylinder controlled by a solenoid valve from an automatic control panel. On the commencement of the cleaning cycle, the solenoid of No. 1 compartment is energised and the isolating damper is closed. After this has been closed for a few seconds, the shaker motor is brought into operation and vibrates the filter bed for some minutes. The motor then stops, and after a delay of a few seconds, the isolating damper opens and the compartment is brought back into service. There is a further delay of several minutes, and the cleaning cycle is then repeated on No. 2 compartment and so on throughout the collector. The frequency of the cleaning cycle may be varied according to different known conditions in each case, or as may be found necessary from experience. It is possible to arrange a delay between the end of the last compartment cleaning cycle and the beginning of the first compartment cleaning cycle. This delay can be varied from 15-min. to 3-hr. by means of a simple time clock. For normal conditions, it is recommended that the cycle should be repeated at 30-min. intervals. The standard Visco "Bermax" dust-collector is designed to handle gases up to a maximum temperature of 120 deg. C., but by the provision of certain special parts, gases with temperatures up to 400 deg. C. can be dealt with. As already stated, the secondary filter medium is graded in size according to the type of dust being handled; in addition, the depth of the medium is also varied. (*Visco Engineering Co. Ltd., Stafford Road, Croydon, Surrey.*)

*Fig. 4 (right). The "Bermax" automatic dust collector showing shaker motors with four covers removed.*

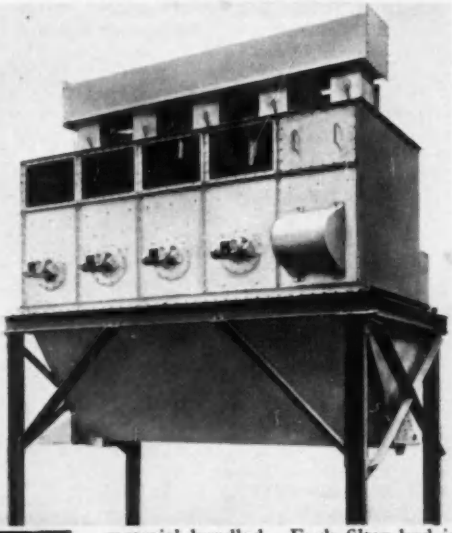
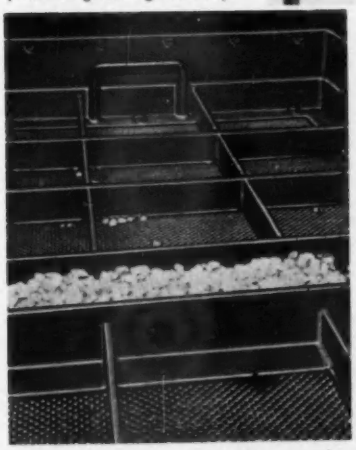


*Fig. 5 (below). A view showing the construction of the "Bermax" filter-beds. (Visco Engineering Co. Ltd.)*



**Self-sealing swivel joint**

The new "Hilyn" swivel joint manufactured by Hilyn Industrial Equipment Ltd. is claimed to solve the problem of reciprocating and rotary movement in rigid pipework where the use of flexible hoses is prohibited by original plant design or space restrictions. Self-sealing and pre-tension is achieved by the internal pressure with additional support from a specially tensioned spring which ensures that even at very low pressures the joint is completely pressure tight. Automatic adjustment of pipework misalignment is possible through 360° with no restriction in flow. A 10° angular or side movement is also catered for within this patented design. Simply constructed, and incorporating only five component parts the "Hilyn" joint requires little or no manual adjustment. Machined from B.S.S. gunmetal it

*Fig. 6. The new "Hilyn" self-sealing swivel joint for steam, water or air pipelines. (Hilyn Industrial Equipment Ltd.)*

is suitable where steam, water, air, etc., is employed, although the joint can be manufactured in malleable iron—aluminium or stainless steel alloys where gunmetal is not suitable. Available in elbow or straight patterns from ¼-in. B.S.P. to 2-in. B.S.P., sizes up to 6-in. B.S.P. can also be supplied to this design. A P.T.F.E. seal is standard to the "Hilyn" range of swivel joints. Subjected to authoritative test pressures exceeding 2,500 lb./sq. in. the joint has remained completely pressure-tight although for normal industrial applications it can be used with complete reliability up to 500 lb./sq. in. and temperatures up to 485 deg. F. For applications involving higher pressures and temperatures special designs are available. (*Hilyn Industrial Equipment Ltd., Hilyn Works, Lockfield Avenue, Brimsdown, Enfield, Middlesex.*)

**Variable speed pulley**

Industrial Drives Ltd. announce further improvements in the design of the "Sextet" variable speed pulley, and they have made available an entirely new model incorporating several interesting features. The design of the pulley has been simplified by making use of splines in place of keys on the sliding surfaces, by reducing the number of working parts, and by the use of a new cover fitting tightly against the moving pulley cone. A further feature of the pulley is the special spring which is designed to reduce the pressure against the sides of the belt at all positions, particularly at bottom pitch circle diameter, thus ensuring a longer belt lift, lower running temperature and easier setting. The spring pressure can be set by means of a screwed adjusting ring, to suit the particular horse-power to be transmitted. The effect of the splines is to provide 360 deg. of engagement around the mating surfaces of the pulley cones, thus giving a smooth sliding action free from the "knocking" associated with conventional keys. "Anti-flux" electro-chemical surface conversion treatment is applied to all the working surfaces of the pulley, in order to prevent fretting corrosion, scuffing during early life, and provide a pre-lubrication film which eliminates the need for frequent applications of grease lubricants. A higher degree of thermal conductivity is obtained, allowing for the cooler running of the pulley and belt. The working parts are completely sealed by the new cover, which can be removed easily whenever it is necessary to apply grease or examine the working parts. (*Industrial Drives Ltd., 44, Uxbridge Road, Ealing, London, W.5.*)

**Compound-flow fan**

A provisional patent (No. 3148/58) has been granted to Keith Blackman Ltd. to cover their Ax-Cent compound-flow fan, which the company says combines the advantages of both the basic axial and centrifugal types. The Ax-Cent fan differs from the conventional axial type in that its cylindrical casing contains a venturi type inlet to a shrouded, compound-

*Fig. 8 (right). The fully-automatic "packaged" Autoflame oil burner. [Auto Combustions (London) Ltd.]*

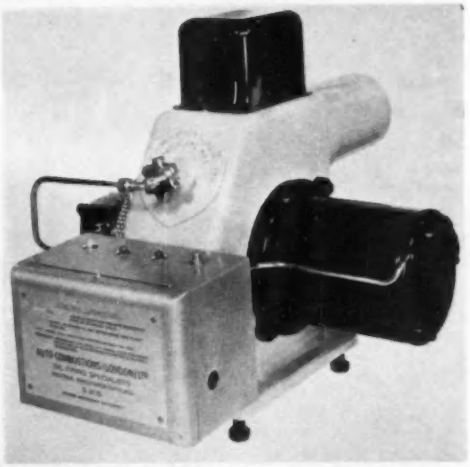
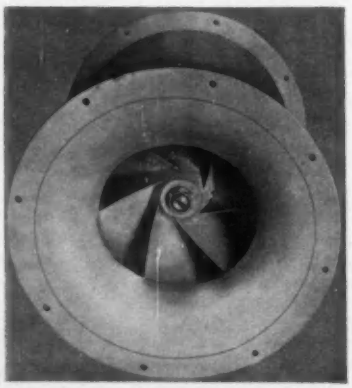


*Fig. 7 (below). The new Ax-Cent compound-flow fan. (Keith Blackman Ltd.)*



flow impeller followed by guide vanes. With its steep pressure/volume characteristic the Ax-Cent fan contrasts sharply with the normal axial type because as a single-stage unit it provides twice the pressure development of the single-stage axial fan running at the same speed, its pressure volume being more comparable with a two-stage axial-type fan. The relatively low sound level and mechanical efficiency of the fan is claimed to compare very favourably with that of a centrifugal fan for equal duty. (*Keith Blackman Limited, Mill Mead Road, London, N.17.*)

**Pressure-jet oil-burner**

Auto Combustions (London) Ltd., manufacturers of the well-known "Swirlamiser" medium-pressure-air burners, have now made available a new burner, the "Autoflame," a fully-automatic "packaged" unit with built-in "on/off" controls. It is completely factory assembled, wired and tested, and it is only necessary to connect the thermostat, power and fuel for immediate operation. A special combustion head has been designed to give the maximum degree of efficiency and the company claim that on a converted solid-fuel sectional-boiler, a combustion efficiency of over 80 per cent. has been obtained. The built-in photoelectronic control box, which provides automatic control of the lighting up cycle, together with instantaneous flame-failure control, incorporates a phototransistor flame-failure device of the very latest design. Instead of using the conventional valve, amplifier and heat-timer, a robust light-sensitive transistor crystal valve is employed. A feature of the "Autoflame" is the "Micromatic" air control, which is an entirely novel method of controlling the combustion air setting. "Micromatic" air control eliminates all need for fan shutter adjustment, and consequently there is no fan shutter on the burner. The external air control screw which is connected directly to the combustion head ensures accurate and instantaneous control of the combustion air setting and permits the correct volume of air to be introduced at a constant velocity. This eliminates pulsation and produces an intense stable flame. Suitable for all boilers or air heaters with capacities from 80,000 to 300,000 B.Th.U./hr., the "Autoflame" burns gas or diesel oil having a viscosity not exceeding 40 sec. Redwood No. 1 at 100 deg. F. [*Auto Combustions (London) Ltd., 360-364, Wandsworth Road, London, S.W.8.*]

**Air-cooled heat exchangers**

At the recent Chemical & Petroleum Engineering Exhibition the Heat Exchange Division of Wellington Tube Works Ltd., exhibited a range of heat exchange equipment, including an example of their "Weldex" air-cooled heat exchangers. The company state that interest in direct air-cooling is now widespread, and it is possible that in many future refineries and chemical plants this form of cooling will largely replace the use of water cooling systems. The "Weldex" unit exhibited was, in fact, designed for installation in an oil refinery. It was of the four-fan type, and consisted of rows of finned tubes arranged horizontally between headers to form standardised tube bundles. These rest on a welded tubular support structure which also carries the air plenum chambers, of which there are four, one for each fan. The bundles are made up of 1-in. o.d. steel tubes, about 12 gauge in thickness, with aluminium fins ½-in. high mechanically bonded to the tube in a spiral. Fabricated from boiler plate, the headers are built to a pressure vessel code. The fans are driven through a right-angled gearbox from a horizontal motor and arranged for dual speed so as to give maximum economy of power when the ambient temperature is below the design summer temperature. The air is delivered vertically upwards into the plenum chamber which distributes it uniformly. (*Wellington Tube Works Ltd., Heat Exchange Division, Great Bridge, Tipton, Staffordshire.*)

---

**Brook Motors Ltd.** announce the formation of a Canadian subsidiary company, to be known as **Brook Electric Motors of Canada Ltd.** Offices have been secured at 250 University Avenue, Toronto, and business commenced there on October 1st. Although Brook have had agency representation in Canada since 1914, and have numbered that country among their best customers, recent developments have shown that more concentrated efforts could yield better results and improve service to existing clients. Director and vice-president of the new company will be **Mr. A. E. Hogton,** who has been director and vice-president of the Brook American subsidiary in Chicago for the past year. Mr. Hogton was formerly in control of production and planning at Huddersfield, and has been with the company since 1917. Personnel leaving the British organisation for Canada will be Mr. H. W. Lumb, who will handle sales, and Mr. R. Booth, who will have charge of the commercial and office organisation.

* * *

**Stordy Engineering Ltd.,** Cumbria House, Goldthorn Road, Wolverhampton, announce that they are now able to supply the complete range of the fully-proportioning oil-burner, together with the special ancillary equipment which has been developed by the Hauck Organisation of America. The company hold the licence to manufacture Hauck combustion equipment including, in addition to the proportioning oil-burner, the micro-cam oil valve; the self-clean metering oil valve; the combination proportioning oil and gas burners; radiant tube burners (for either oil or gas); and radiant-tube gas burners.

* * *

**Birlec Limited** and **Efco Limited,** two of the leading electric furnace manufacturers, announce that negotiations between them for the formation of a new company, to take over certain sections of their business, have reached an advanced stage. It is intended that the new company shall be called **Birlec-Efco (Melting) Ltd.,** and that its offices shall be near Birmingham, at Aldridge, Staffs. The intended scope of the company is the design and supply of all types of electric melting furnaces for the ferrous and non-ferrous metals industries, together with smelting furnaces and induction heating equipment. The two companies will continue independently to manufacture their respective heat treatment furnaces and other plant.

**Elliott-Automation** announces that its subsidiary company, Associated Automation, has signed agreements with both the Farris Engineering Corporation of New Jersey and the Farris Flexible Valve Corporation. A new company, Farris Engineering Ltd., has been formed to manufacture and sell throughout the whole of Europe, the British Commonwealth (except Canada) and the Middle East, the Farris range of safety-relief valves and pinch-type "Flex Valves." **Mr. H. R. Walton** and **Mr. A. M. Reid,** both of whom have been associated with the Group's valve business for many years, have joined the board of Farris Engineering Ltd. Farris safety-relief valves are extensively used in the oil extraction, petroleum refining, gas and chemical industries. They are also widely used in ships and in electricity generating stations. The Elliott-Automation Group already has an extensive business in automatically-controlled valves. With the addition of the Farris valves, the Group can now offer a comprehensive range of valves in the field of automatic control. It includes Fisher Governor valves, widely used in the petroleum industry, and the "Continental" range of butterfly valves. Through its subsidiary, **Sauter Controls Ltd.,** the group has an important business in valves for use in heating and air-conditioning, and through **James Gordon & Co. Ltd.,** it makes a range of special valves for marine and power station plant applications.

* * *

We have received from **Richard Hill Ltd.,** Middlesbrough, a new leaflet describing "Maxweld" electrically welded wire-mesh screen cloth, an important application of which is the accurate grading of coal, coke, etc. "Maxweld" is available in mesh sizes from ¾-in. upwards, and in any size material from 10 S.W.G. wire to ¾-in. dia. bar.

* * *

**The British Thomson-Houston Export Co. Ltd.** has obtained a contract from Fuerzas Electricas de Cataluna, of Barcelona, for a 60-MW steam turbine generator, boilers, and all auxiliary plant. The sub-contractors for the boilers are John Thompson Ltd., Wolverhampton, and the subcontractors for the civil engineering design and layout, Balfour, Beatty & Co. Ltd. The turbo-alternator will be made at one of the works of the A.E.I. turbine-generator division. The value of the contract is £2,250,000.

In the October issue of this journal, we made reference to the annual conference of the **Combustion Engineering Association,** which is to be held at Scarborough on November the 11th and 12th. As stated in our reference, the first day will be devoted to examination of the Fourth Annual Report of the National Industrial Fuel Efficiency Service. The subject for discussion on the second day of the conference has now been settled, and it will be a study of the problems facing local authorities and industry in implementing the Clear Air Act of 1956. It is considered that the time is now opportune for a factual discussion between representatives of local authorities and industry on the ways in which problems in implementing the Clean Air Act could be best overcome. Personal contacts and co-operation between all concerned should materially assist in achieving this, and the Association hope that the conference will be well supported so that the maximum benefit will be obtained. (Full details can be obtained from the director, The Combustion Engineering Association, 6, Duke Street, St. James's, London, S.W.1 (telephone No. Whitehall 5536).

* * *

**The British Thomson-Houston Co. Ltd.** have published a new booklet (G.13751), which deals with the installation and care of electric motors and control gear. The booklet is a revised and enlarged version of a booklet on the subject which was first published by B.T.H. in 1953. Much useful information is given on installation, maintenance, diagnosis of faults, and causes and effect of unsatisfactory performance. A copy of the publication will be sent to anyone professionally interested, on application to the Publicity Department, B.T.H., Rugby.

* * *

**Simon-Carves Ltd.,** Cheadle Heath, Stockport, have issued a new brochure entitled: "Civil Engineering." This includes details and illustrations of numerous complete civil engineering contracts carried out by the company for both national and industrial requirements.

* * *

**Elcontrol Ltd.** have issued a new 12-page Data sheet "FS" describing two out of the three ranges of flame-failure equipment which they now manufacture. The publication deals very fully with the operation and use of Elcontrol industrial flame-failure and ignition programming controllers.

# OVERSEAS Steam Engineering Practice

*Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment*

### Nuclear reactor for district-heating scheme

A nuclear-energy plant, to be built by the Swedish State Power Board, and which will be completed by 1960-61, is to be used as a means of heating water for the central heating of buildings in the town of Västerås. The reactor is of the thermal heterogeneous type, and the fuel used is natural uranium in the form of sintered uranium dioxide. The moderator, the coolant and the reflector are heavy water. There are four main coolant circuits arranged in parallel, and connected in series with the moderator, thus forming a common heavy-water system. The outlet temperature of the heavy water from the reactor is 140 deg. C., and the temperature of the returning water is 85 deg. C. The primary heavy-water cooling systems are separated from the secondary cooling system of light water leading to the town by the tube walls in the heat exchangers. Mechanically, the reactor is a pressure vessel with an ellipsoidal bottom and a flat cover, all made of stainless steel. The vessel is designed for a pressure of 19 atmospheres and a temperature of 210 deg. C. In the flat cover there are 200 access pipes, placed in a square lattice, of which 168 are for fuel elements and 32 for control rods. The access pipes for the fuel elements pass through the top shield up to the level where the fuel-handling machine can be connected to the pipes. The fuel elements consist of clusters of 19 fuel rods. The sintered uranium dioxide pellets, which have a diameter of 13.5 mm., are canned in finned aluminium tubes. These tubes are milled from thicker aluminium tubes and the fins follow a spiral line around the rod. The 19 rods are kept apart from each other by the fins, and held together by a corrugated aluminium tube surrounding them, the cooling water passing between the fuel rods inside the corrugated aluminium tube. The complete fuel element can be removed through the corresponding fuel-access pipe in the flat cover. The coolant, having passed upwards through the fuel elements, is collected in the plenum mounted at the inner side of the flat cover. The water leaves the reactor through the four main outlet pipes, then passes the main heat exchangers and the main pumps and returns to the reactor vessel. The thermal shield consists of a cylindrical plate of mild steel, clad with stainless steel, and an equivalent thermal shield is used in the bottom of the reactor. The reactor vessel is entirely filled with heavy water and thermal expansion of the water is allowed for by an expansion vessel. The water is continuously purified by means of a mixed-bed ion-exchanger system. The control rods move into the reactor from above, and are 32 in number, arranged in a square pattern. The absorbing material is cadmium, clad in stainless steel. The rods move directly in the moderator water. The fuel elements are removed from the reactor and replaced by means of a charging machine, which can be attached to any of the fuel-access pipes under hermetically sealed conditions. It then unscrews the tightening plug, removes the irradiated fuel element, introduces a fresh element into the reactor and tightens the access pipe by screwing the plug into position. The irradiated element is then transported to one of the fuel element storage basins in the station. The reactor portion of the new plant, together with auxiliary equipment, is being designed by the ASEA organisation of Sweden. (*ASEA Journal*, Vol. 31, No. 6, pp. 81/82.)

### 1-Million lb./hr. boiler for New York State

The Milliken power station, the largest unit of the New York State Electric & Gas Co., is situated 16 miles north of Ithaca, New York, on the shore of Lake Cayuga. The main station building is 150-ft. high, and the single chimney provided is 250-ft. high. The boiler plant installed has a capacity of 1,000,000 lb./hr., and supplies steam at 1,800 lb./sq. in. at 1,000 deg. F., with reheat at 1,000 deg. F., to a tandem-compound, triple-flow, reheat turbo-alternator unit having a design capacity slightly in excess of 150-MW, and which will normally operate at 135-MW. Power is generated at 13.8 kV and stepped-up to 115-kV for transmission. The generator is of the inner-cooled design, with hydrogen-gas being forced through hollow stator conductors to effect a more efficient heat transfer. Coal is received by rail wagon, and is unloaded with a rotary wagon tippler. A 1,000 ton/hr. capacity belt conveyor transports the coal to a storage area from which it is reclaimed through four hoppers. Beneath the hoppers, coal is fed by vibrating screen feeders, through crushers, to a 600-ton/hr. conveyor system for transport to 700-ton capacity bunkers in the boiler house. The entire reclaiming system is operated from a central control room, permitting the operator to set the feed rate, and determine the bunker level, by means of indicating and recording instruments. Cayuga Lake provides an excellent source of cold, clean circulating water at all times of the year. The intake is of sufficient capacity to supply two units, and consists of an 8-ft. steel pipe extending 500-ft. off shore, terminating at a depth of 50-ft. Two 43,750 gal./min. pumps provide circulating water to the condenser as well as feeding the suctions of miscellaneous pumps. Boiler make-up water is chlorinated, filtered, and demineralised prior to entering the system. Seven stages of feedwater heating are used. There are four low-pressure closed heaters and a deaerating heater of 1,050,000 lb./hr. capacity which floats on the turbine extraction line. The deaerator horizontal storage tank has a capacity of 28,000 gal. From the deaerator, the feedwater passes to the boiler feed pumps and through two streams of high-pressure heaters. The steam generator is of the tangentially-fired, tilting burner design, and four pulverising mills are provided, each serving four burners. The burners tilt above or below horizontal to cause more or less heat to be absorbed in the furnace, thereby controlling the final steam temperature. Supplemental control is provided by spray water injected ahead of the secondary superheater and reheater. Operation of the coal-handling plant, boiler, turbo-alterna-

tor, and switching arrangements are supervised by two operators from a central control room. Here the instrument panels, arranged with all related controls grouped together for ease of operation, comprise boiler feed, draught, soot-blowing, coal pulverising, temperature, coal-handling, turbine and electrical. To reduce fly-ash discharge an electrostatic precipitator is provided, the collected ash being deposited in hoppers. A completely automatic system is employed to transport the ash to a silo, with final disposal by means of dustless unloaders into trucks which haul both fly-ash and furnace bottom ash to a disposal area. Since no contaminated waste is permitted to enter Cayuga Lake, an automatic low-head ash system was developed which recirculates large volumes of low-pressure water to remove ash from the boiler ash hoppers, while fluctuations in water demand are provided for by a surge-tank. Ash is pumped from the hoppers to a hydrobin where excess water is decanted prior to loading of the ash into the trucks for disposal. Water drained from the hydrobin flows to the surge tank where it is stored for the next ash sluicing cycle. The system is provided with automatic controls which ensure the correct flow of water to the pumps, and automatic protection is available for shut-down in the event of a failure in the water supply. Construction of a duplicate boiler/turbine unit is now under way, and this will be commissioned during the year.

**Condensers for Staythorpe**

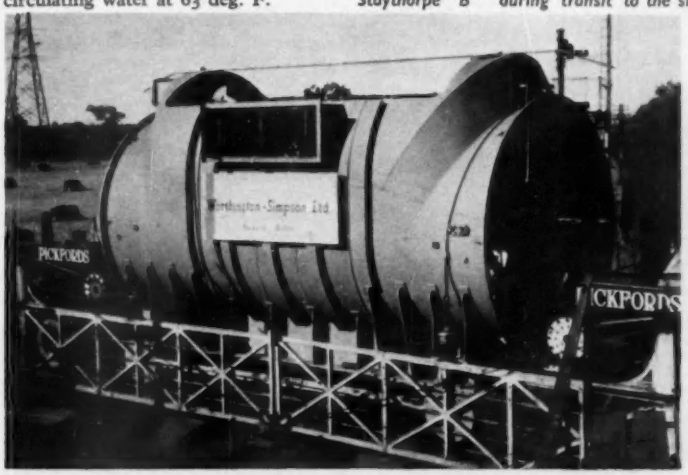
Good progress is being made on the Central Electricity Generating Board, East Midlands Division, Northern Group's new Staythorpe "B" power station near Newark, Notts., and recently the first of six condenser shells for the three 120-MW sets being supplied by Metropolitan-Vickers Electrical Co. Ltd. left the works of Worthington-Simpson Ltd. for delivery to the site. These three sets will have steam conditions at the turbine stop valve of 1,500 lb./sq. in. and 1,000 deg. F., with reheat to 1,000 deg. F. Steam will be provided by three 860,000 lb./hr. boilers to be supplied by John Brown Land Boilers Ltd. On this occasion the shell had to be transported in one piece although it is often possible to move similar shells in sections and weld them together on site. This particular condenser shell, therefore, presented something of a haulage problem. It measured 25-ft. 6-in. long by 13-ft. 9-in. wide, and reached the unusual height of 19-ft. when loaded on the trailer. The weight of the shell was 30-tons, although in complete working condition the total weight of the condenser will be 130-tons. It will, for example, be fitted with 6,368 brass tubes of 1-in. dia. and their total weight is nearly 39-tons. Each twin condenser set will have a surface area of 85,000 sq. ft., and has been designed to condense 576,560 lb./hr. of steam at an absolute pressure of 1.3-in. Hg. when supplied with 58,000 gal./min. of circulating water at 63 deg. F.

**Babcock & Wilcox Limited** have received a repeat order from C. A. La Electricidad de Caracas, Venezuela, amounting to approximately £400,000, for a large boiler, the third of its size supplied by the company to that electricity undertaking, which is responsible for the whole of the electricity supply in the Caracas area. All parts of the boiler will be manufactured in the Babcock works at Renfrew, Scotland, and shipped to Venezuela for assembly on site. These boilers, which will be oil-fired, or gas-fired with natural gas piped from neighbouring oilfields, are of the fully-pressurised radiant type with a capacity of 550,000 lb./hr. of steam at a pressure of 1,300 lb./sq. in. and a temperature of 950 deg. F. An interesting feature of the boiler design is that no expanded tube connections are used, all boiler drums, superheater boxes and similar ancillary parts are being fabricated at the works with welded tube-stubs for site-welded connections.

* * *

Head Wrightson & Company Limited announce the appointment of **Mr. George Taylor** as assistant general manager of Head Wrightson Steel Foundries Ltd. Mr. Taylor, who commenced his apprenticeship with the company in 1932, became works manager of their Stockton branch in June, 1956.

*The first of six Worthington Simpson condenser shells for the three 120-MW sets at Staythorpe "B" during transit to the site.*




**Jones, Tate & Co. Ltd.,** Bradford, have issued a preliminary specification (No. 501) describing their electric sequence controller. This unit achieves automatic sequence of electric motor driven equipment, without the use of telephone-type relays which are unsuitable for many heavy industrial applications. The equipment is simple, robust and readily maintained. Control signals and full motor current are taken through the sequence distributor itself. The distributor is suitable for operation on 440 volts, 3-phase supply and the contact rating is equivalent to a motor rated at 1 b.h.p. Over 60 complete control systems have been supplied to date. It is believed that this controller will prove to have a wide application throughout industry for sequence control. The whole of the equipment is mounted in a cubicle-type control panel of totally-enclosed dust-proof construction. Provision is made for the small selector switch control panel to be separately mounted if required, to give complete remote control and indication from a convenient position, and at the same time permit the minimum length of power cabling from the main cubicle to the controlled units. The system can be arranged to "close down" if any manual action at the machine or unit under control is contrary to correct action. Full technical information and advice is always available, either from the company's Bradford works, or from 165, Great Dover Street, S.E.1.

* * *

**Whessoe Ltd.** has been awarded the contract for the supply and construction of the pressure vessel for the U.K. Atomic Energy Authority's advanced type of gas-cooled graphite-moderated reactor. The vessel is to be a vertical cylinder about 21-ft. in dia. with hemispherical ends. The overall height is to be 53-ft. 6-in. It is to be constructed from notch ductile steel plate of considerable thickness. The duct head will be perforated by a large number of closely-pitched charge tube and control rod standpipes for refuelling and controlling the reactor. The complex internal arrangements include the support of the heavy core and graphite moderator and the shielding material. The internal baffles are ranged in such a manner that the relatively cool inlet gas sweeps the entire pressure vessel shell. This advanced design plant will operate at considerably higher temperatures than those employed in nuclear power stations currently under construction.

# PHOSPHATES
## in boiler water treatment

**PHOSPHATE CONDITIONING**

is thoroughly established as the most satisfactory method of preventing calcium and magnesium scale deposits in all types of boilers. Such deposits cannot form when a phosphate reserve and correct alkalinity conditions are continuously maintained in the boiler water.

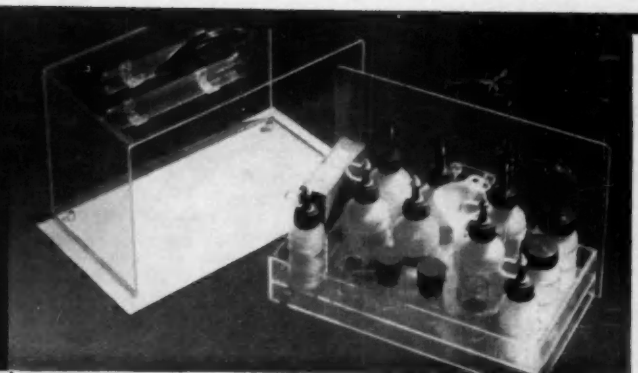
Indispensable at high pressures, phosphate conditioning at low pressures leads to such improvements in results that it is generally preferred to other forms of treatment.

Ask your supplier of boiler conditioning chemicals how little you would have to pay to be sure your boiler is scale-free *all the time*.

TDW 518

CONTROL
IS
SIMPLE

Control of PHOSPHATE CONDITIONING and testing of raw and softened waters is a simple matter using Albright & Wilson's NEW WATER TESTING KIT



For booklet on Boiler Water Conditioning and leaflet describing Albright & Wilson's Water Testing Kit please complete coupon and post to:

ALBRIGHT & WILSON
(MFG) LTD
*Water Treatment Department,*
1 Knightsbridge Green
London SW1
*Tel: Kensington 3422*

*Please send me your booklet on BOILER WATER CONDITIONING WITH PHOSPHATES and leaflet on WATER TESTING KIT:*

NAME _____

POSITION IN COMPANY _____

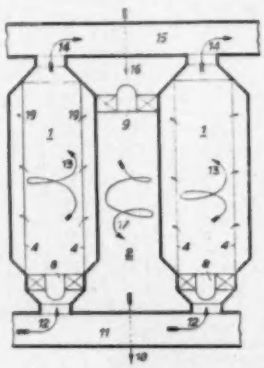
ADDRESS _____

# Latest Power Plant Patents

*These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)*

## Heat-exchanger

This invention relates to heat-exchangers of a type comprising hollow elements for conveying a fluid, and arranged side-by-side to define exterior spaces for conducting a second fluid which flows either in concurrent or in countercurrent direction. According to the invention, baffles are arranged within the hollow elements in order to cause a pronounced swirl of the fluid, and preferably a similar swirling motion is imparted to the fluid in the spaces between the elements. Slots may be provided in the walls of the hollow elements to effect withdrawal of the boundary layer of the internal and/or external fluid streams. Referring to Figs. 1 and 2, the heat-exchanger



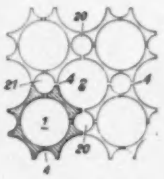
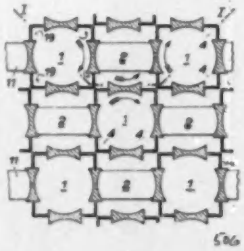


*Fig. 1 (extreme left). Fig. 2 (below, left). Fig. 3 (left). British Patent No. 799,486.*



comprises hollow elements (1) through which one of the heat-exchange fluids is passed and which are juxtaposed to confine passages (2) for conveying a second fluid in countercurrent or concurrent flow. Figs. 1 and 2 illustrate the hollow elements (1) as of square configuration in plan view and having their walls in part represented by members which are part-cylindrically concave at opposite sides, so that when juxtaposed in staggered rows, such elements confine internal and external fluid passages of substantially the same cross-sectional area. Each element (1) has slots (4) between its bi-concave walls to effect withdrawal of the boundary layers of the internal and external fluid stream. The internally flowing fluid enters the hollow elements (1) from the manifolds (11) in the direction of the arrows (12), and on reaching the baffles (8) it receives a generally helical motion indicated by the arrows (13), leaving the installation in the direction of the arrows (14) through the manifolds (15). The second heat-exchange fluid conveniently enters at the top and in the direction of the arrow (16) between the manifolds (15), and by virtue of the guides (9) it traverses the passages (2) between the elements (1) with a helical motion as indicated by the arrow (17), thereafter escaping as indicated by the arrow (18). The boundary layers of the fluid streams inside and outside the hollow elements (1) are withdrawn by the edges of the slots (4). Fig. 3 shows another construction of the hollow elements (1), the rows of which are not staggered in this instance. The numeral (4) denotes slots for withdrawal of the boundary layers and these are discharged into passages (20 and 21). In a case where the elements and passages (2) respectively convey fluids which are not readily miscible and/or are at widely different pressure, the boundary layers may be withdrawn from the passages (2) only. *British Patent No. 799,486 issued to Waagner-Biro A.G. Complete specification published August 6th, 1958.*

## Vertical smoke-tube boiler

The combination of a water-cooled combustion chamber with a horizontal smoke-tube boiler requires a considerable amount of floor space. It is also usually necessary to place the smoke-tube boiler at as high a position as possible, like a steam drum, in view of the circulation in the cooling tubes of the combustion chamber, so that an extremely robust framework is necessary to support the smoke-tube boiler. According to the invention it is proposed to place the combustion chamber parallel to the vertical smoke-tube boiler, and to separate it therefrom by an intermediate flue. In Figs. 4 and 5,

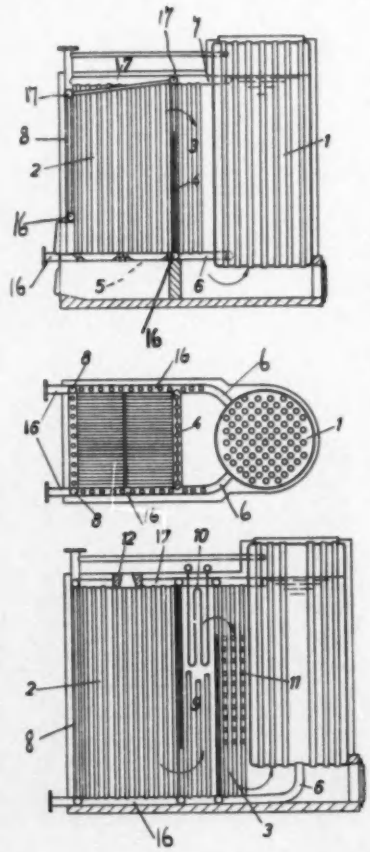


*Fig. 4 (top). Fig. 5 (centre). Fig. 6 (bottom). British Patent No. 799,785.*

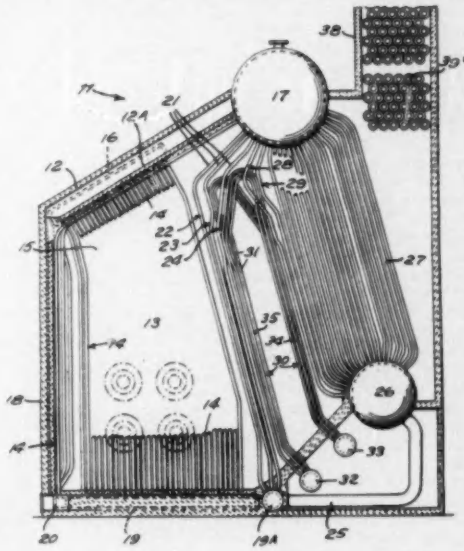
an intermediate flue (3) is arranged between the smoke-tube boiler (1) and the combustion chamber (2). The combustion chamber (2) and also the intermediate flue (3) are cooled on all sides by water-tubes.

The gases emerge from the upper part of the furnace (2) over a wall (4) into the intermediate flue (3), in which they flow downwards and after a deflection through 180° enter the smoke-tube boiler (1) from below. The rear wall of the intermediate flue (3) is formed by part of the wall of the smoke-tube boiler, so that this part of the wall is utilised as a heating surface. The intermediate flue (3) is separated from the combustion chamber (2) by a closed, gas-tight tube wall (4). This intermediate wall (4) is formed from tubes, which lie side-by-side with spacing, the intermediate space being bridged up to the upper gas-passage aperture by sheets welded in between. Instead of these sheets, double fins can also be welded on each tube in the plane of the wall, these fins extending close to the double fins of the adjacent tube, and to the intermediate spaces which are packed with asbestos. The cross section of the intermediate flue (3) is adequate in consequence of the curvature of the boiler wall. In spite of its cylindrical shape, the smoke-tube boiler (1) is connected on the narrowest floor space to the rectangular furnace-chamber (2) by the arrangement of the intermediate flue (3) without disturbance to the unitary construction. The cooling tubes limiting the fire chamber (2) on all four sides are connected to lower and upper headers (16 and 17) respectively. The water-tube system surrounding the fire chamber (2) is connected with the smoke-tube boiler by the lower longitudinal tubes (6) and the upper longitudinal tubes (7) which are extensions of the side headers (16 and 17) respectively. For the purpose of improving the circulation, tubes (16 and 17) are connected together at their free ends by return tubes (8). A substantial part of the circulation water is separated in the four upper headers (17), and by-passing the smoke-tube boiler, flows directly back to the water-tube system surrounding the furnace chamber. Together with the upper and lower transverse tubes, the connecting tubes (6 and 7), the return tubes (8), and the vertical tubes surrounding the furnace chamber form a tube cage, which renders a special boiler framework superfluous. In the arrangement shown in Fig. 6, the burners (12) are placed in the roof of the furnace chamber (2) and the combustion gases flow downwards. Since in the case of oil or pulverised fuel, a larger flame path is required than in the case of mechanical stoker-firing, two intermediate flues (3 and 9) are provided. A superheater (10) is located in the intermediate flue (9). An evaporator (11) is located in the intermediate flue (3). *British Patent No. 799,785 issued to H. Vorkauf. Complete specification published August 13th, 1958.*

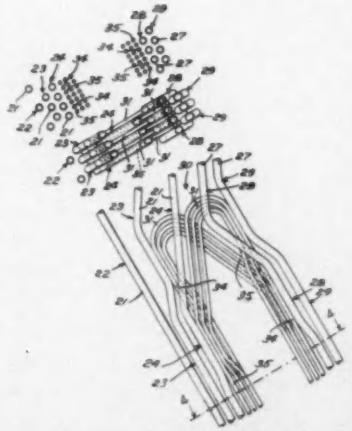
**Supporting superheater elements**

Fig. 7 shows an outline arrangement of a marine boiler (11) in a setting (12) having a roof (12a) of a combustion chamber (13) lined with boiler tubes (14). A bank of vertical (slightly inclined) boiler screen-tubes (21) is arranged on the side of combustion chamber (13) opposite the wall (18) between the front of the setting (12) to the rear wall (15). The tubes (21) are arranged in three parallel rows (22, 23 and 24). The tubes (27) are substantially parallel with the tubes (21) and are connected at their upper ends to the drum (17) and at their lower ends to the water drum (26). Two rows of tubes (28 and 29) of the bank (27) are bent at their upper ends differently from the other remaining tubes of the bank. A superheater (30) comprising elements (31) is disposed in the space between the tubes (21) of the row (24) and the tubes (27) of the row (28). The elements (31) are vertical and slightly inclined, and the ends connected to a superheater inlet-header (32) and a superheater outlet-header (33). Each superheater element (31) comprises a pair of substantially parallel legs (34 and 35). The leg (34) of each superheater element (31) is substantially straight throughout its entire length and merges into the arcuate intermediate part of the element. The leg (35) is substantially straight to a point vertically below the point where the leg (34) merges into the arcuate part and thereafter is inclined toward the opposite leg (34) to merge into the arcuate portion near that point. Figs. 8, 9 and 10 show in outline, that the superheater elements (31) are arranged in parallel planes which are horizontally spaced and that the elements are arranged in a predetermined pattern in which the tube in one plane is rotated through 180° from the position of the superheater tubes in the preceding and succeeding planes. The elements are nested within one another. Each of the outermost elements (31) is is co-planar with a tube (21) of the row (23 or 24) and a tube (27) of the row (28 or 29). Fig. 9 shows that the first plane containing superheater tubes (31) has the outermost tube engaged by a boiler tube (21) in the row (24) which then runs parallel to the inclined part of the superheater

*Fig. 7 (right). British Patent No. 801,767.*




*Figs. 8, 9 and 10 (below). British Patent No. 801,767.*



tubes (Fig. 8). The leg (34) of the outermost element (31) is engaged by a tube (27) in the row (29) and the superheater elements (31) in each row are thus supported. In the next plane, the leg (34) of the outermost element (31) is engaged by a tube (21) in the row (23), and the leg (35) of the element (31) in the same plane is engaged by a tube (27) in the row (28). It will be noted that the tubes (21) of row (24) and tubes (27) of row (28) extend across the superheater elements (31) to some extent, and on both sides of the nested elements, to prevent lateral movement. In this manner motion of the superheater elements (31) is constrained in all directions except along their length, to permit thermal expansion of the latter. *British Patent No.* 801,767, *issued to Foster Wheeler Ltd. Complete specification published September* 24*th*, 1958.

---

### Foxboro-Yoxall Training School

An important side of Foxboro-Yoxall's comprehensive industrial control instrument service, is the training school now installed at the company's new factory at Redhill. The school was started in 1951 to meet the growing demand for training by Foxboro-Yoxall's customers. Something more than sporadic instruction in one or other of the company's factories was needed and so a fully-equipped and staffed training school was set up at Wandsworth. Only limited accommodation was then available but more than 700 people received training between 1951 and 1958 with some 10 per cent. coming from overseas. At first, instruction was confined to two-week maintenance courses. Later advanced courses were also provided. Now, at Redhill, the school is installed in spacious premises specially-designed for the study of instruments in the light of the experience gained over the past eight years at Wandsworth. Each student has a bench equipped with compressed-air and electrical supplies. Full ranges of Foxboro-Yoxall instruments, control valves and auxiliary equipment are provided for the student to dismantle, re-assemble, calibrate and adjust under typical conditions. Adjoining this workshop area are offices for the instructional staff and a modern lecture room. The new premises have a greatly increased capacity, but in order to maintain the school's policy of the individual approach, courses are at present limited to nine students. The courses are of three weeks' duration and comprise :—*Maintenance Course A* —designed to give instrument mechanics with limited experience on industrial instrumentation practical training in the use and maintenance of Foxboro equipment. Emphasis throughout this course is on the practical aspect of the subject. *Advanced Instrument Course B* —is designed for technical instrument engineers, and covers the theory of control instrumentation and its application to industrial processes. *Special Courses*—related to particular user industries are given from time to time. These have recently included one on instrumentation in the paper-making industry, and another on instrumentation for coal-washing plants.

* * *

We were recently invited by **Geo. W. King Ltd.,** Argyle Works, Stevenage, Herts, to view a short industrial film which deals with their main products, and shows actual installations in operation throughout the country of the many types of mechanical-handling equipment in which the company specialise. This 16 mm. film, entitled "Kings in Industry," has a running time of 24-min., and is available on loan, free of charge.

**Mr. T. A. G. Madden,** B.Sc.(Tech.), M.I.Mech.E., M.I.E.E., has been appointed production, inspection and test engineer of the Central Electricity Generating Board. Mr. Madden served a period of apprenticeship at the Ribble Power Station, Preston, and this was followed by a three-year post-graduate course with International Combustion Ltd., Derby. Subsequently, he held the posts of assistant engineer, Steam Generation Division and later, engineer, Advisory Engineering Division, with International Combustion Ltd. Following service with the City of Norwich Electricity Department as generation technical assistant, Mr. Madden became assistant technical engineer, Mechanical and Constructional Section, with the Corporation of Liverpool Electric Supply Department. From 1948-1952 he held the position of construction engineer with the Merseyside and North Wales Division of the then British Electricity Authority, and March, 1952, he was appointed the co-ordinating engineer (General Construction) at the board's headquarters in London, which post he now relinquishes to take up his new duties.

* * *

The Lord President of the Council has appointed **Vice-Admiral Sir Frank Mason,** K.C.B., M.I.Mech.E., M.I.Mar.E., to be a member of the Council for Scientific and Industrial Research. Sir Frank Mason is a director of Metal Industries Ltd., and H. W. Kearns and Co. Ltd., and consultant to Metropolitan-Vickers Electrical Co. Ltd. He was appointed chairman of the Mechanical Engineering Research Board last June. Before his retirement from the Royal Navy in 1957, Admiral Mason was engineer-in-chief of the Fleet.

* * *

Crompton Parkinson Ltd. announce that **Mr. P. D. Osborn,** A.M.I.E.E., has assumed complete responsibility for the sale of motors produced at its Guiseley factory. He will continue to represent the company in trade association matters. **Mr. C. J. Teasdel** has been appointed product sales manager, Chelmsford machines, covering large motors, d.c. marine motors, generators and alternators.

* * *

Babcock & Wilcox Limited announce the appointment of **Mr. J. H. Prole** as assistant manager of the company's Mechanical Handling Division. Mr. Prole has for many years been closely concerned with the design and supply of Babcock ash and dust handling equipment and also, more recently, with the expansion of the Mechanical Handling Division's activities into other fields such as the bulk handling of ore, phosphates and chemical products.

**Mr. R. Farrall,** M.I.E.E., has been appointed services engineer of the Central Electricity Generating Board. In 1947 Mr. Farrall joined the Directorate of Power Station Equipment, Ministry of Supply, which was then formed to co-ordinate the production of equipment for the national programme of power station construction, and in 1949 transferred to the production, inspection and test branch of the British Electricity Authority which took over this function. In 1950 he was appointed principal assistant engineer, and in 1953 production, inspection and test engineer—which post he relinquished to take up the appointment of services engineer in June, 1958.

* * *

Recent appointments in the manufacturing departments of Metropolitan-Vickers Electrical Co. Ltd. include those of **Mr. D. Hutton,** A.M.I.Mech.E., as assistant superintendent, switchgear department ; **Mr. V. D. Swain,** B.Sc. (Eng.), as assistant superintendent, control department, **Mr. F. G. Rose,** as assistant superintendent, main production and **Mr. K. R. Johnston,** B.Sc.(Eng.), as assistant superintendent, plant department.

* * *

**Mr. David J. Thomas,** A.M.C.T., M.I.E.E., South Wales Area manager, **Lancashire Dynamo Group Sales Ltd.,** has retired after an association of 30 years with Lancashire Dynamo. He is succeeded by **Mr. F. R. Williams,** A.M.I.E.E., who has served with Mr. Thomas at Cardiff since 1953.

* * *

The board of Associated Electrical Industries Limited have decided to appoint a director of central services, and **Mr. G. E. Walker,** O.B.E., has been elected to the board to fill this appointment. Mr. Walker will continue to be secretary of the company.

* * *

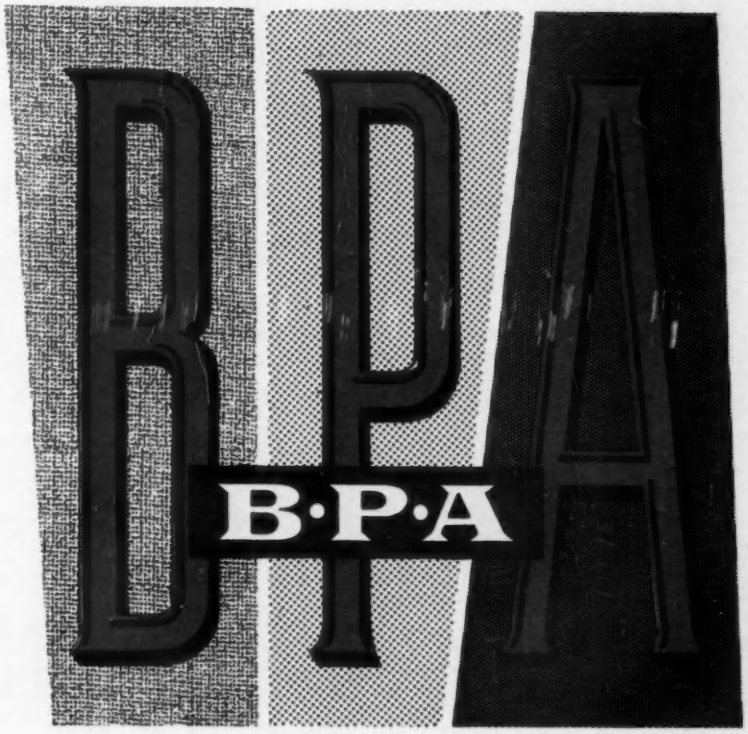
It is with regret that we record the death recently of **Mr. E. M. Johnson,** M.Sc.(Tech.), M.I.E.E. He was formerly chief engineer of Metropolitan-Vickers Electrical Company's plant department (large electrical machines). Relinquishing this position in 1955, he became consultant to the chief electrical engineer until his retirement in February, 1956.

* * *

### Correction

In the October, 1958, issue of this journal, it was stated in connection with the instrumentation associated with the boiler plant at the new Charrington, Gardner, Locket & Co. Ltd. oil-fuel terminal at Poplar, that the B.Th.U. meter was supplied by Kelvin Hughes Ltd. The B.Th.U. meter was, in fact, supplied by Elliott Brothers (London) Ltd.

# You can rely on




In an age when Industry leans more and more towards " Groups," " Divisions " and " Subsidiaries," when the personal enquiry so often becomes the impersonal ' matter ' following a tortuous course through department after department, how refreshing to find ONE well-known independent Company with an unshakable belief in the value of PERSONAL ATTENTION.

The letters **B.P.A.** are an abbreviation for ' **B**attery **P**ersonal **A**ttention '—which ensures that YOUR enquiry is dealt with by a responsible executive who believes that our Customers' requirements are of paramount importance.

That's one reason why " Battery " Products are being so much used for important installations in the Nuclear Power, Electrical, Chemical, Shipping, Petroleum and General Engineering Industries. The high quality of our products is another reason.

**' BATALBRA '** (*Aluminium-Brass*) **TUBES & PLATES**

**' BATNICKON '** (*Copper-Nickel Alloys*) **TUBES, PLATES & SHEETS**
(FIVE, TEN, THIRTY)

**' BATNAVAL '** (*Naval Brass*) **CONDENSER PLATES**

**COPPER TUBES • BRASS & COPPER RODS**

***Large or heavy TUBES & PLATES a speciality***

## THE BIRMINGHAM BATTERY & METAL CO. LTD.

SELLY OAK • BIRMINGHAM 29

*Branch Offices or Warehouses:*

CARDIFF GLASGOW . LIVERPOOL . LONDON . NEWCASTLE . SOUTHAMPTON HULL . YORK

H

# NOTES Personal AND Industrial

Yarrow and Co. Ltd. announce that **Sir Harold Yarrow** has expressed his desire to relinquish his position as managing director of the company. He will, however, remain as chairman. **Mr. Eric Yarrow** has been appointed as managing director from October 1st.

* * *

Powell Duffryn Limited announce that **Mr. W. H. Sharland,** a director of the company, has been appointed deputy chairman, and that **Mr. R. C. Saloway** has been elected to the board.

* * *

**Mr. Bruce M. Adkins,** until recently publicity manager of Elliott-Automation Ltd., has been appointed public relations and information officer to the European Nuclear Energy Agency, a department of the Organisation for European Economic Co-operation, in Paris.

* * *

**Mr. B. R. Cant** has been appointed managing director of Hamworthy Engineering Limited, Poole, Dorset. Mr. Cant has, during the past nine years, held various appointments in the Brush Group of Companies, and latterly was director and general manager of the National Gas and Oil Engine Co. Ltd.

* * *

**Mr. N. S. Billington** has been appointed director of the Heating and Ventilating Research Council. He is succeeded as head of the National College for Heating, Ventilating, Refrigeration and Fan Engineering by **Dr. David R. Scott.**

* * *

**Mr. J. B. Jackson,** M.I.Mech.E., M.I.E.E., has been appointed divisional controller of the North Eastern Division, C.E.G.B. From 1938 to 1946, Mr. Jackson held the position of personal assistant to the generation engineer, and in 1946 became generation engineer, North-Eastern Electric Supply Co. Ltd. Upon nationalisation in 1948, he was appointed chief generation engineer (operation) in the North Eastern Division, the post he now vacates to take up his new appointment.

* * *

**Mr. J. D. Crozier** has retired from the position of managing director of J. D. Crozier and Partners Limited, but continues as chairman of the company. The post of managing director has been taken up by **Mr. F. C. Thornley,** formerly manager of the company's Edinburgh offices.

* * *

The Electricity Council have appointed **Mr. Malcolm Skinner,** B.Com., assistant to the secretary of the National Joint Advisory Council, to be joint consultation officer in the council's industrial relations department. Mr. Skinner joined the electricity supply industry in 1949 as secretary to the South Western and South Wales District Joint Advisory Councils, and took up his appointment at headquarters in 1954.

**Mr. C. E. Roebuck** has been appointed chief estimating engineer of the newly-created engineering estimating department at Steel, Peech and Tozer, a branch of the United Steel Companies Limited. **Mr. D. E. Barker** succeeds Mr. Roebuck as chief planning engineer.

* * *

Head Wrightson & Company Limited announce that **Mr. Norman Addison,** who has been commercial director of Head Wrightson Iron Foundries Ltd. since its formation in February, 1957, has now been appointed director and general manager of that subsidiary company.

* * *

G. A. Harvey & Co. (London) Ltd. announce that **Mr. H. E. Cooper** has been appointed managing director of the company. Mr. Cooper, first appointed to the board in 1946, has been acting as deputy managing director since May of this year. **Mr. I. A. Marriott** succeeds **Mr. P. T. Bliss** as sales director. Mr. Bliss, who has been with the company for 50 years, retires on December 31st next.

* * *

**Mr. O. S. Woods,** A.M.I.Mech.E., A.M.I.E.E., chief generation engineer (operation) of the East Midlands Division of the Central Electricity Generating Board has been appointed Controller of that Division. Mr. Woods joined the London Passenger Transport Board in 1940 as personal technical assistant to the chief engineer, subsequently becoming assistant resident engineer at the Board's Neasden power station. In 1944 he was appointed assistant resident engineer at the Ironbridge power station of the West Midlands Joint Electricity Authority, and later joined the Manchester Corporation Electricity Department as engineer at the Barton power station. In 1948, Mr. Woods joined the North Western Division of the former British Electricity Authority as generation engineer (operation), and three years later was appointed to the East Midlands Division post which he has now relinquished to become Controller of the Division.

* * *

C. A. Parsons & Company Limited announce that **Mr. G. M. Baker,** who has for a number of years been chief mechanical engineer, has now been appointed general manager. Mr. Baker is also a director of the company.

* * *

It is with regret that we record the death on October 7th, at the age of seventy-two, of **Mr. E. W. Steele,** M.I.Mech.E., M.I.E.E. He was formerly a director, and had also since 1940 been general manager of works of Metropolitan-Vickers Electrical Co. Ltd., retiring from executive duties in March, 1954, after being with the company for thirty-five years. Mr. Steele was also chairman of Metropolitan-Vickers-Beyer, Peacock Ltd., from its formation in November, 1949 to March, 1956. Metropolitan-Vickers-Beyer, Peacock Ltd. was formed to enable the experience of both companies to be utilised in the building of diesel-electric, electric and gas-turbine locomotives.

* * *

The Chancellor of the Duchy of Lancaster (**Dr. Charles Hill**) is to be the guest of honour, at the luncheon on November 12th, at the Connaught Rooms, London, on the occasion of the third B.E.A.M.A. Publicity Conference, which will be under the chairmanship of **Mr. Lewis Hart,** publicity consultant, Brush Electrical Engineering Co. Ltd., and will cover two days, viz.—November 11th and 12th. There will be three sessions of the conference on the first day, and two sessions and the luncheon on the second day. After the luncheon, Dr. Hill will speak on " Overseas Publicity." It is stated that about 200 registrations have already been received from member-firms of the British Electrical and Allied Manufacturers Association for the conference.

* * *

**The Superheater Co. Ltd.** has removed its London office from 53, Haymarket, S.W.1, to 97, Tottenham Court Road, W.C.1. Telephone No. Langham 0431.

* * *

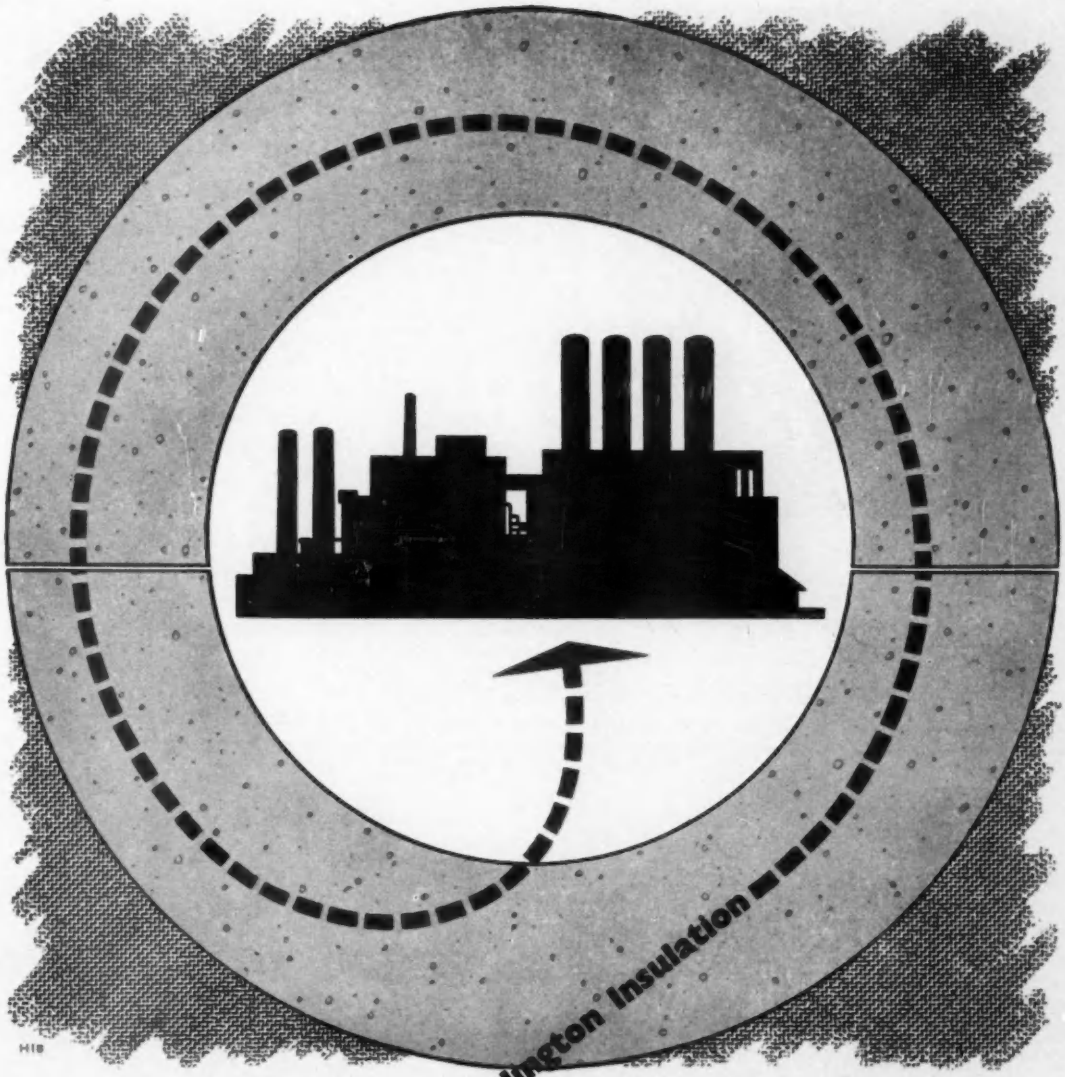
**Hayward Tyler & Co. Ltd.,** members of the Platt Brothers group, have received instructions to supply three heavy-water main coolant glandless circulators for the German materials-testing reactor to be built at Julich.

* * *

**Simmonds Aerocessories Pty. Ltd.,** an Australian subsidiary of **Simmonds Aerocessories Ltd.,** Treforest, Glamorgan, have announced plans for a new factory and administrative building to be built on a site near to the company's present factory in the Guncotton Area of Ballarat, Victoria. **Mr. J. Hanford Stevens,** managing director of the Australian company in making the announcement, stated that there was an increasing demand throughout Australia for the company's products.

* * *

**The United Kingdom Atomic Energy Authority** announce that they propose to move from Harwell to Winfrith Heath, near Dorchester, the whole of the controlled thermonuclear project. This work will be transferred from Harwell to Dorset during the period 1961-63. This change will permit the development of both fission and fusion work at Winfrith, and allow room for whatever expansion of the latter is necessary in the future. It will also provide a margin for new work as yet unseen which will undoubtedly be developed at Harwell. It is stated that this plan will not in any way make the site more hazardous.




Year after year the Central Electricity Generating Board's list of power stations with the highest operating efficiencies includes a majority of stations where the efficiency is guarded by Darlington Insulation. In the 1957 list, for example, the top four stations are Darlington insulated.
Coincidence ? Not a bit of it ! Just skill and years of experience, plus careful specifications and the right materials.
It's The Darlington Insulation Company's job to help maintain high thermal efficiencies, and they do it very well.

**THE DARLINGTON INSULATION CO. LTD**

**38 Great North Road, Newcastle upon Tyne, 2**

and branch offices at London, Birmingham, Bolton, Bristol, Cardiff, Glasgow, Leicester and Sheffield.

*A Member of The Darlington Group of Companies*

**Mr. H. F. SPENCER — Managing Director of RICHARD THOMAS & BALDWINS LTD. writes:—**

*"Although we have our own fuel engineering department occasions arise when we could do with additional qualified staff. A Regular Service Agreement with N·I·F·E·S provides us with a call on fully trained reserves.*

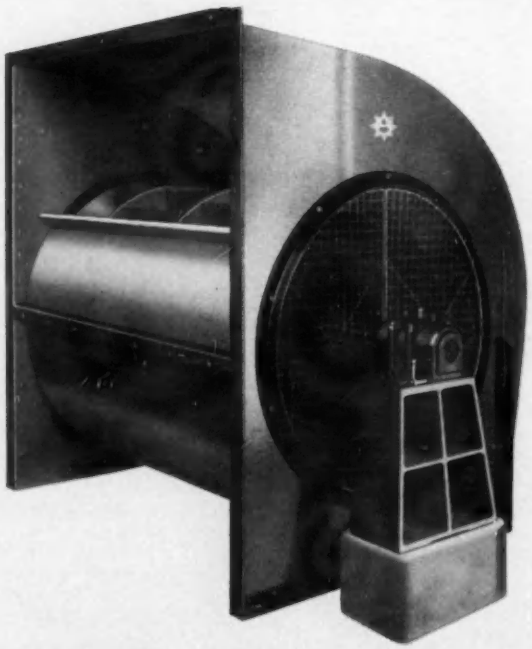
*In my opinion no business is too big or too small to benefit from a similar arrangement."*

CALL IN N·I·F·E·S — INDUSTRY'S OWN NON-PROFIT-MAKING SERVICE FOR ADVICE ON THE EFFICIENT USE OF ALL FUELS, HEAT AND POWER.

*For address of nearest Area Engineer write to:—*

N·I·F·E·S *National Industrial Fuel Efficiency Service*

*Head Office:* **71 GROSVENOR STREET LONDON W1** · *Telephone:* Hyde Park 9706



# FANS

**FORCED AND INDUCED DRAUGHT**

**EXHAUSTERS**

**PRIMARY AIR**

**SECONDARY AIR**

**RECIRCULATING**

**FANS FOR ALL OTHER PURPOSES**

# ALLDAYS & ONIONS LTD.

GREAT WESTERN WORKS, BIRMINGHAM, 11. TELEPHONE: VICtoria 2251-4

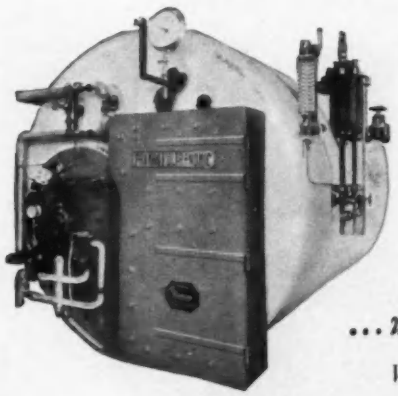
LONDON OFFICE: 2, QUEEN ANNE'S GATE, WESTMINSTER, S.W.1. TELEPHONE: WHitehall 1923-4-5

*Two Paxman Double Pass 'Ultranomic' hot water heaters provide the heating for Eltham Green School, Middle Park, London, S.E.9.*

*Architect: J. L. Martin, M.A., Ph.D., F.R.I.B.A.*
*Architect to the L.C.C.*

*Heating Engineers: J. Rawlinson, C.B.E., M.Eng., M.I.C.E., M.I.Mech.E.*
*Chief Engineer to L.C.C.*

# ... modern buildings need modern BOILERS!



Even perfectly designed buildings will fall short of expectations unless the efficiency of the installations are completely in keeping. Discriminating heating and ventilating engineers know that Paxman boilers are extremely reliable and economical—that's why they are always first choice.

Davey, Paxman & Co. Ltd. are aware that heating experts are always seeking higher standards of boiler efficiency, and are confident that not only can they meet these requirements in every respect —they can surpass them.

That is why . . .

***... whatever your problem – Paxman have the answer!***

*Write for full details and fully illustrated literature to:*

**DAVEY, PAXMAN & CO. LTD.**

**COLCHESTER · ENGLAND**

**TELEPHONE: COLCHESTER 5151-6**

**TELEGRAMS · PAXMAN · COLCHESTER · TELEX 1875**

*ALSO MAKERS OF DIESEL ENGINES, ROTARY VACUUM FILTERS AND HEAVY FABRICATION WORK*

B 62

*-for Quick Delivery of*
# ENGINEERING SUPPLIES

HOP
8022
(25 lines)

**COCKS, VALVES, GAUGES,**
**PACKINGS, JOINTINGS,**
**BELTINGS, VEE-ROPES,**
**OILS, GREASES, etc.**

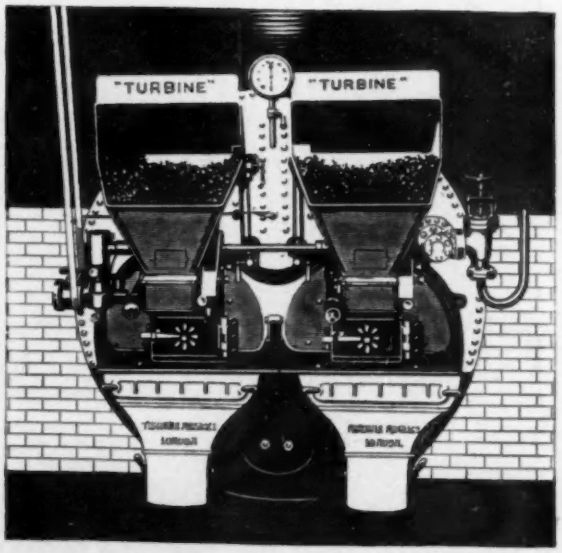
*Write or phone –*

W. H. WILLCOX & CO., LTD.
SOUTHWARK HOUSE, S.E.1

# TURBINE
(PATENT)
# FURNACE

*mechanically fired maintain*
**A CLEAN CHIMNEY**
**& BOILER EFFICIENCY**

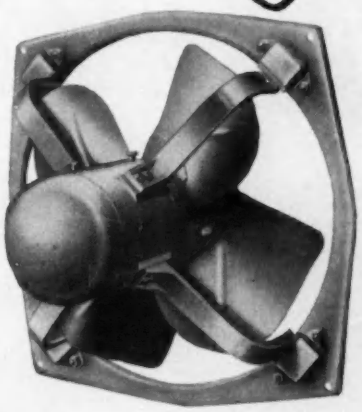
*Our investigation of your present*
**STEAM COST** *may result in a*
*considerable* **FUEL ECONOMY**




**THE TURBINE FURNACE Co LTD**
238b, Grays Inn Road, London, W.C.1 *TERminus 4365*

# Quality

*costs less in the long run*



The quality of engineering in WOODS propeller fans means lasting reliability and economy from long service. Remember, WOODS are the world's most widely used fans, chosen internationally for performance and quality.

**DELIVERIES FROM STOCK FROM ALL G.E.C. BRANCHES**

*Write for Publication V1220, it should be on your files.*

**WOODS propeller fans**

WOODS OF COLCHESTER LTD., BRAISWICK WORKS, COLCHESTER

*An Associate Company of The General Electric Co. Ltd., of England.*

FAN ENGINEERS AT THE FOLLOWING BRANCHES: ABERDEEN, BELFAST, BIRMINGHAM, BRISTOL, CARDIFF, EDINBURGH, GLASGOW, LEEDS, LEICESTER, LIVERPOOL, LONDON, MANCHESTER, MIDDLESBROUGH, NEWCASTLE-ON-TYNE, NOTTINGHAM, SHEFFIELD.

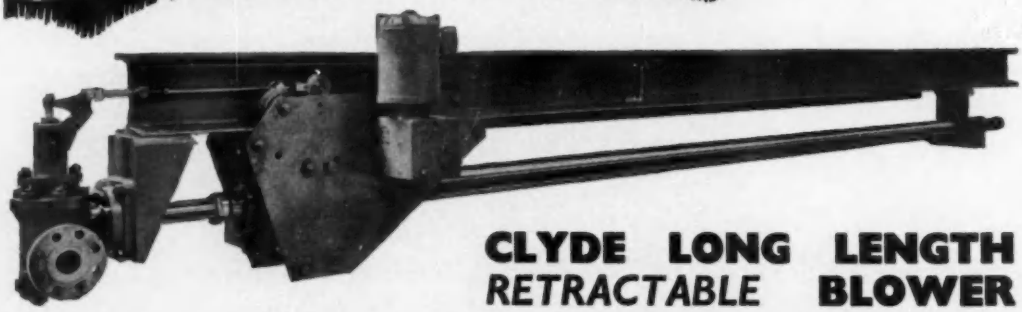
MECHANICAL STOKERS—FORCED DRAUGHT FURNACES—CONVEYORS—ELEVATORS

NIAGARA ENGINEERING CO. LTD.

20 BRAZENNOSE STREET,
MANCHESTER 2
DEANSGATE 7930/7939

EARLS COURT,
LONDON, S.W.5
FROBISHER 2111/2

Clyde SOOT BLOWERS
in general supply throughout the world



CLYDE LONG LENGTH
*RETRACTABLE* BLOWER

This Blower is used to clean the heating surfaces where short stroke Single Nozzle Blowers, or other types, are not applicable due to the boiler design. The lance tube is projected, rotated and retracted by individual motors. Automatic push button control is provided by wall mounted starter, or by Cubicle.

By pressing the push button steam is admitted, the blower operated and stopped automatically with lance tube in the withdrawn position.

*There is a Clyde Blower applicable to every type of Boiler—Land or Marine.*

CLYDE BLOWERS LTD

CLYDEBANK SCOTLAND

TELEPHONE: CLYDEBANK 2161/4 TELEGRAMS: "MURWILS," GLASGOW

LONDON: 34 Victoria Street, S.W.1 Phone: ABBey 1847

'BOSS' SEAMLESS WELDING FITTINGS
Take advantage of our large stocks of Welding fittings, Valves and Pipe-line Equipment.
WRITE FOR LITERATURE TO :
THE BRITISH STEAM SPECIALTIES LTD.
HEAD OFFICE
FLEET STREET • LEICESTER
TEL: LEICESTER 20885/6/7 • GRAMS: 'BOSS' PHONE LEICESTER
LONDON • LIVERPOOL • GLASGOW • BRISTOL • MANCHESTER
NEWCASTLE-ON-TYNE • BIRMINGHAM • BELFAST AND DUBLIN

**Fosalsil Insulating Bricks**

**M.P. Insulating Refractories**

**Fosalsil Lightweight Slab Insulation**

In scope and quality, an unequalled range of insulating materials

**MOLER PRODUCTS LIMITED, Colchester**

MOVEMENT of pipe work under modern high-pressure and high-temperature conditions is absorbed efficiently by Teddington Bellows Expansion Joints. Teddington Bellows are of highest quality stainless steel, flawlessly butt-welded to ensure perfect uniformity of wall for maximum durability. Normal production ranges from 1 inch to 7 feet diameters and larger sizes can be made. Let's get together and solve your own particular expansion problems.

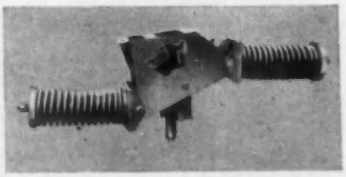
Teddington Bellows are produced in technical collaboration with the Solar Aircraft Co., U.S.A.

*Send for our descriptive brochure E.115*

PIPES ON THE MOVE PREFER **TEDDINGTON BELLOWS**

TEDDINGTON AIRCRAFT CONTROLS LTD., INDUSTRIAL BELLOWS DIVISION, AMMANFORD, CARMARTHENSHIRE. TEL: AMMANFORD 455

# Vokes Genspring Support Hangers in searching corrosion test



Twenty years' service under really severe marine atmospheric conditions has no appreciable effect on the mechanical efficiency of a Vokes Genspring Constant Support Hanger—this was established in a test recently carried out by an independent research laboratory. Using the A.R.E. salt droplet test (BSS. 1391.1952), this ten-week test was designed to represent 20 years of service exposure. Corrosion of the Vokes Genspring Hanger was negligible, even under the severe conditions found near the sea coast, and efficiency checks before and after corrosion tests indicated less than 1% increase in maximum deviation at any position of the travel. Specified for the first three Nuclear Reactor Power Stations (all situated near the sea), Vokes Genspring W3 and W4 Constant Support Hangers have already proved their efficiency. These tests confirm that they will continue to give trouble-free service for many years to come, even in highly corrosive salt-laden atmospheres. Copies of the full test report are available on request.

*If you have a pipe suspension problem please write for advice or literature. The two Vokes Genspring catalogues give full details of the different types of Support Hangers, both Constant and Variable.*

**Vokes Genspring**

SUSPENSION SYSTEMS

DEPT. J/5 · VOKES GENSPRING LTD · GUILDFORD · SURREY

VG/21

ELLIOTT GORDON

**For complete**

**AUTOMATIC CONTROL AND INSTRUMENTATION**

**of any type or size of**

# Boiler Plant

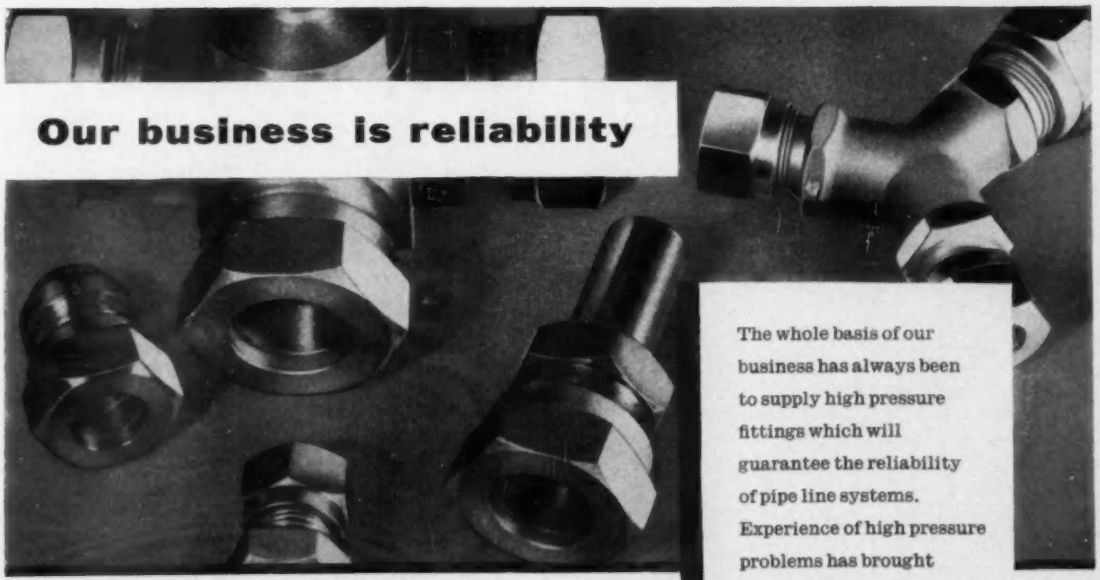
**consult**

**JAMES GORDON & CO. LTD., DALSTON GARDENS, STANMORE, MIDDX.**

**Telephone: Wordsworth 3631**

**INCORPORATING THE POWER PLANT DIVISION OF ELLIOTT BROTHERS (LONDON) LTD.**

**A MEMBER OF THE ELLIOTT-AUTOMATION GROUP**



**Our business is reliability**

The whole basis of our business has always been to supply high pressure fittings which will guarantee the reliability of pipe line systems. Experience of high pressure problems has brought with it the large range of fittings now produced by Ermeto.

ERMETO

*Details of high pressure couplings and valves will be sent on request.*

**British Ermeto Corporation Ltd, Hargrave Rd, Maidenhead, Berks. Tel: Maidenhead 5100 (10 lines)**

LARK
ESTABLISHED 1933

# LARK
## tube-cleaning equipment

LARK Tube-cleaning Equipment can be supplied with either electric, pneumatic or hydraulic motors.

Flexible shafts, Cutter heads and all tools necessary for the descaling of Boilers, Condensers, and Oil Still tubes are available in a wide range of sizes from ½ in. to 16 in. diameter.

*Catalogues illustrating and describing the whole range of LARK tube-cleaning products are available on request. Please mention reference E.B.R.*

**INDUSTRIAL DESCALING TOOLS LTD**
Sole distributors for the manufacturers H. WILLIAMS & SON LTD
LARK WORKS, SANDRIDGE ROAD, ST. ALBANS, HERTS.
Telephone St. Albans 56026 Telegrams Descaltool, St. Albans

---

## To indicate TEMPERATURE

For accuracy, ease of reading, robustness, economy and long, trouble free life install Rototherm instruments. Thermometers, Controllers and Recorders are available to suit most industrial Marine and Laboratory requirements. Specialists in bi-metallic applications. *Write for details.*

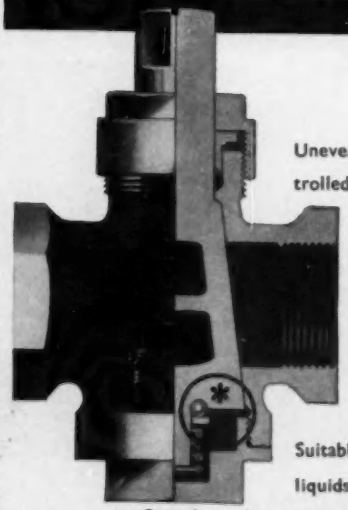
**Rototherm**

*BI-METAL · MERCURY-IN STEEL · VAPOUR PRESSURE*

**THE BRITISH ROTOTHERM CO. LTD.**
Merton Abbey, London, S.W.19. LIBerty 7661
Nottingham Factory: Hollis St., New Basford. Phone 77847

---

## THIS COCK DOESN'T JAM



Uneven expansion is controlled by spring-fed ball bearings which keep the plug always free in the barrel. Made in sizes ¼ in. to 6 in. with flanged or screwed ends. Suitable for steam, gases, liquids or liquors.

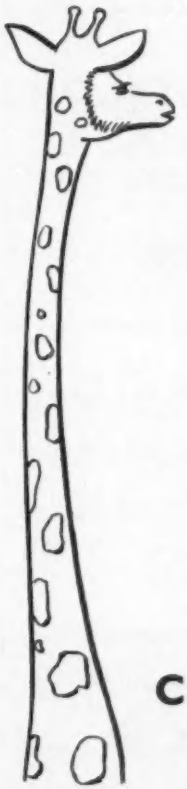
Cast Iron for up to 50 lb. p.s.i.
Gunmetal for up to 200 lb. p.s.i.

**UNITED STATES METALLIC PACKING CO. LTD.**

Soho Works, Bradford 8
Telegrams: "Metallic," Bradford
Telephone 41284-5

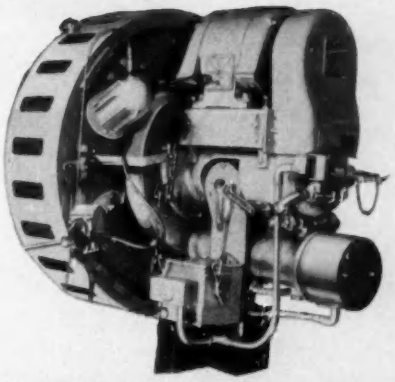
**U.S.M.P**

Branch Offices: London, Liverpool, Glasgow, Manchester, Newcastle, Cardiff, Southampton, Hull, Swansea and Bristol.



## . . . the long view on oil burners

The performance of an oil firing installation in ten or twenty years' time is *just* as important as its performance today. That's why so many engineers specify Clyde oil burners . . . they know that Clyde Fuel Systems have been producing some of the finest oil burners in the business for over thirty years, burners designed and built to give a lifetime of efficient, dependable operation . . . and that all Clyde burners are put into commission by a first-class service organisation with branches throughout the country.



*Among our wide range is the Clyde Hero rotary cup burner which will burn the heaviest fuel oils at a very high efficiency while still remaining adaptable to a variety of automatic and semi-automatic control methods.*

**CLYDE FUEL SYSTEMS LIMITED**

**Queen Elizabeth Ave., Hillington, Glasgow, S.W.2.**
*Telephone: Halfway* 3291.

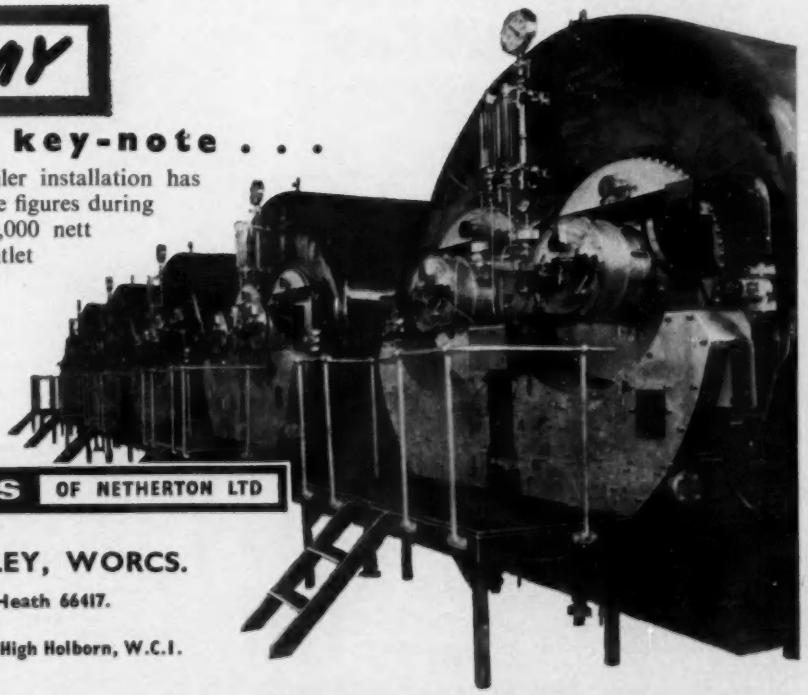
---

**ECONOMY**

**is the key-note . . .**

This new super-economic boiler installation has produced excellent performance figures during the past twelve months. £20,000 nett saving has been effected. Outlet temperatures of 400°-450°F. with $CO_2$ up to 13% have been easily maintained.

*Nightingale Road Factory, Derby. Photograph by courtesy of Rolls-Royce Ltd.*



**DANKS** OF NETHERTON LTD

**NETHERTON, DUDLEY, WORCS.**

**Telephone: Cradley Heath 66417.**

**London Office: Bank Chambers, 329 High Holborn, W.C.1.**

**save oil**
**save coal**
**save gas**

*save explosions too!*

*Write now for descriptive literature of*

**AERCON DRAUGHT BALANCES**

A great many AERCON draught balances have been and are being installed by County Councils, Education Authorities and leading Heating Engineers and Industrial Organisations

*also for details of the*

**AERCON EVACUATION VALVES**

for maintaining air at a predetermined pressure

***to* Power Utilities Ltd.**

**LOMBARD HOUSE, GREAT CHARLES STREET, BIRMINGHAM, 3 'Phone: Central 3446-7-8-9**

**BURFORD, TAYLOR**
**AND COMPANY, LIMITED,**
**MIDDLESBROUGH**

**BOILER PLANT**

***We can offer you from stock:—***

**Water Tube Boilers**

1 Marine 6,000 lbs. evap. 135 lbs. w.p.

1 Cornish 1,400 lbs. evap. 190 lbs. w.p.

*Also*

FANS, MOTORS, PUMPS,
VALVES, PIPING, ETC.

For the really awkward job
...when pipe-line systems are so complicated that ordinary couplings are quite useless, call in Simplifix. We make non-standard fittings of all kinds, tailored to specific requirements. Our Service Department has had such a wide experience of individual problems in this field, that it can certainly solve yours.
SIMPLIFIX
Regd. Trade Mark
SIMPLIFIX COUPLINGS LTD., Hargrave Rd., Maidenhead, Berks. Tel: Maidenhead 5100 (10 lines)

# IVO

Long established and highly specialised in offering exceptional service and guaranteed completion dates

**Our Refractory Brickwork Dept. Offers:**

- ★ Immediate and free survey and estimates
- ★ Large stocks of all Refractory Materials
- ★ Highly skilled, experienced and mobile labour force
- ★ Unequalled day and night service

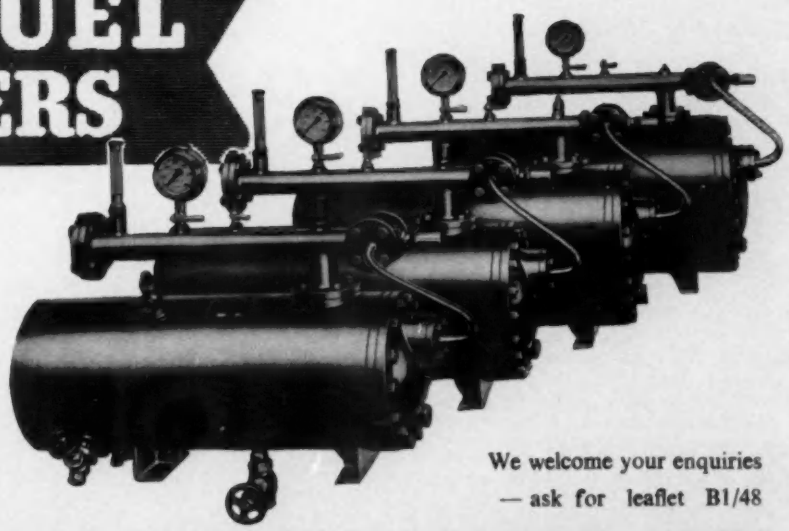
**Our Steel-Fabrication Dept. Offers:**

- ★ Immediate quotations against phoned or post enquiries
- ★ Site survey carried out and working drawings prepared
- ★ Site welded oil tanks to B.S.S. a speciality
- ★ Chimneys, flues, gantries, tanks and dampers, etc.

# IVO

**Engineering & Construction Co. Ltd.**
WOOD LANE, LONDON, W.12 · Tel: SHEpherds Bush 4382/5

# OIL FUEL HEATERS



by Caird & Rayner Ltd., for all grades of Fuel Oil and Creosote Pitch. Standard sizes to deal with 10 to 2,000 gallons per hour using Steam or High Pressure Hot Water as heating media.

We welcome your enquiries — ask for leaflet B1/48

# Caird & Rayner LTD

777 COMMERCIAL ROAD, LONDON, E.14. TELEPHONE: EAST 3216 (3 lines). TELEGRAMS: "VAPORIZE LONDON"

# Index to Advertisers


| | Page |
|---|---|
| Airetool Mfg. Co. Ltd. ... ... ... | xxxiii |
| Albright & Wilson Ltd. ... ... ... | 378, 379 |
| Alldays & Onions Ltd. ... ... ... | lvi |
| Allen, W. H., Sons. & Co. Ltd. ... ... | xlii |
| Auld, David, & Sons Ltd. ... ... ... | xviii |
| Babcock & Wilcox Ltd. ... ... ... | liv |
| Bennis Combustion Ltd. ... ... ... | xvii |
| Birmingham Battery & Metal Co. Ltd. ... | 383 |
| British Ermeto Corporation Ltd. ... ... | lxiii |
| British Paints Ltd. ... ... ... ... | xii |
| British Rototherm Ltd. ... ... ... | lxiv |
| British Steam Specialties Ltd. ... ... | lxi |
| Burford Taylor & Co. Ltd. ... ... ... | lxvi |
| Caird & Rayner Ltd. ... ... ... | lxvii |
| Cape Asbestos Co. Ltd. ... ... | xxiv, xxxii |
| Classified Advertisements ... ... ... | lxviii |
| Clyde Blowers Ltd. ... ... ... ... | lx |
| Clyde Fuel Systems Ltd. ... ... ... | lxv |
| Crane Ltd. ... ... ... ... ... | xliii |
| Crosthwaite Furnaces & Scriven Machine Tools Ltd. ... ... ... ... ... | xxxix |
| Danfoss Manufacturing Co. Ltd. ... | *Front Cover* |
| Danks, E., & Co. (Oldbury) Ltd. ... ... | liii |
| Danks of Netherton Ltd. ... ... ... | lxv |
| Darlington Insulation Co. Ltd. ... ... | lv |
| Davey, Paxman & Co. Ltd. ... ... ... | lvii |
| Dicks Asbestos Co. Ltd. ... ... ... | xliv |
| Evershed & Vignoles Ltd. ... ... ... | xx |
| Fibreglass Ltd. ... ... ... ... | xxxi |
| Flexible Shaft Mfg. Co. Ltd. ... ... | lxix |
| Foster Wheeler Ltd. ... ... ... ... | xix |
| Glenboig Union Fire Clay Co. Ltd. ... | xiv |
| Gordon, J., & Co. Ltd. ... ... ... | lxiii |
| Green, E., & Son Ltd. ... ... ... | xxxvi |
| Hargreaves Ltd. ... ... ... ... | xlvi |
| Hopkinsons Ltd. ... ... ... ... | xiii |
| Houseman & Thompson Ltd. ... ... | xxix |
| Imperial Chemical Industries Ltd. ... ... | xxxiv |
| Industrial Descaling Tools Ltd. ... ... | lxiv |
| Ivo Eng. & Construction Co. Ltd. ... | lxvii |
| Keith Blackman Ltd. ... ... | xv, *Back Cover* |
| Kennedy, Allan & Co. Ltd. ... ... ... | x |
| Klinger, Richard, Ltd. ... ... ... | xxviii |
| Lafarge Aluminous Cement Co. Ltd. ... | iv, xl |
| Lancashire Dynamo & Crypto Ltd. ... | xlvii |
| Mitchell Engineering Ltd. ... ... ... | ii |
| Moler Products Ltd. ... ... ... ... | lxi |
| Morgan Refractories Ltd. ... ... ... | xxii |
| Musgrave & Co. Ltd. ... ... ... ... | xviii |
| National Industrial Fuel Efficiency Service | lvi |
| Negretti & Zambra Ltd. ... ... ... | vi |
| Niagara Eng. Co. Ltd. ... ... ... | lx |
| Permutit Co. Ltd. ... ... ... ... | iii |
| Power Utilities Ltd. ... ... ... ... | lxvi |
| Reavell & Co. Ltd. ... ... ... ... | xi |
| Richardsons Westgarth Co. Ltd. ... ... | v |
| Riley (I.C.) Products Ltd. ... ... ... | vii |
| Simon-Carves Ltd. ... ... ... | xvi, xxv |
| Simplifex Couplings Ltd. ... ... ... | lxvi |
| Slip Group of Companies ... ... ... | ix |
| Spanner Boilers Ltd. ... ... ... ... | xlix |
| Spirax-Sarco Ltd. ... ... ... ... | xxxvii |
| Starit Ltd. ... ... ... ... ... | xxxviii |
| Stockton Chemical Engineers & Riley Boilers Ltd. ... ... ... ... ... ... | viii |
| Sturtevant Engineering Co. Ltd. ... ... | li |
| Superheater Co. Ltd., The ... ... ... | xxiii |
| Teddington Aircraft Controls Ltd. ... | lxii |
| Thompson, J., (Triumph Stoker) Ltd. ... | xlv |
| Thompson, J., (Wilson Boilers) Ltd. ... | xlv |
| Thompson, J., Wolverhampton Ltd. ... | xxxv |
| Turbine Furnace Co. Ltd. ... ... ... | lviii |
| United Filters & Eng. Ltd. ... ... ... | xli |
| United States Metallic Packing Co. Ltd. ... | lxiv |
| Versil Ltd. ... ... ... ... | xxvi, xxvii |
| Vokes Genspring Ltd. ... ... ... | lxii |
| Ward, Thos. W., Ltd. ... ... ... | l |
| Weir, Valves, Ltd. ... ... ... ... | xxi |
| Whiffen & Sons Ltd. ... ... ... | xlviii |
| Wicksteed, Chas., & Co. Ltd. ... ... | xxx |
| Willcox, W. H., & Co. Ltd. ... ... | lviii |
| Woods of Colchester Ltd. ... ... ... | lix |

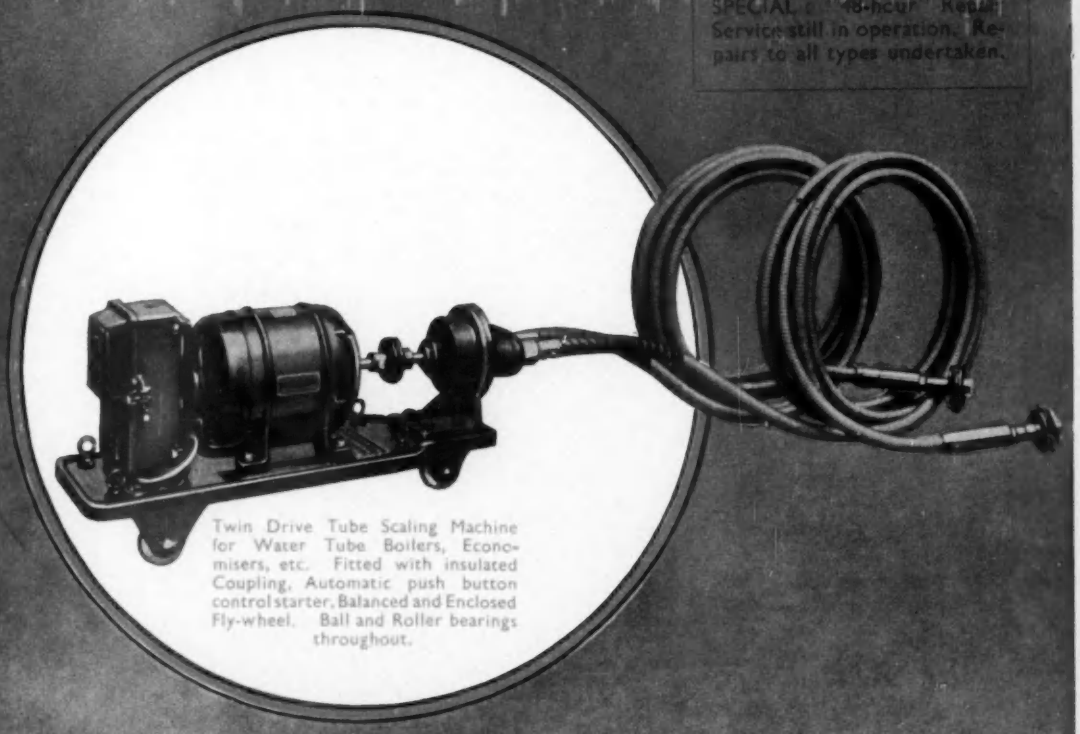


## CLASSIFIED ADVERTISEMENT

WATER TUBE BOILER. Yarrow type triple drum water tube boiler. Evap. 12,500 lb./hr. when oil fired. Working pressure 400 lb./sq. in. Boiler manufactured 1939 complete with fittings and mountings and can be supplied with oil burner, fans, etc. Size 12 ft. 6 in. high x 11 ft. 6 in. x 10 ft.—GEORGE COHEN SONS & COMPANY LIMITED, Wood Lane, Shepherds Bush, London, W.12. Telephone : Shepherds Bush 2070.

# Flexible Shafts *and* Flexible Shaft Driven Tools

SPECIAL "48-hour" Repair Service still in operation. Repairs to all types undertaken.



Twin Drive Tube Scaling Machine for Water Tube Boilers, Economisers, etc. Fitted with insulated Coupling, Automatic push button control starter, Balanced and Enclosed Fly-wheel. Ball and Roller bearings throughout.

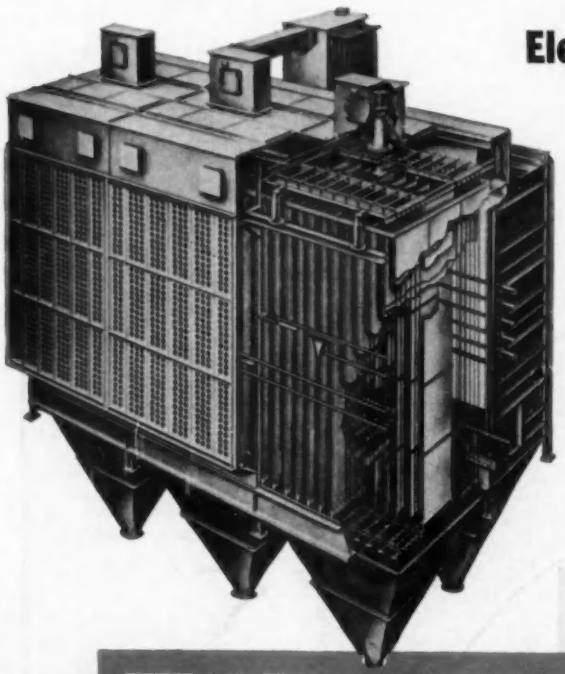
Grinding, Polishing, Buffing, Sanding, Tube Scaling and Tube Brushing Machines, etc., etc. Manufactured throughout in our own Works. As supplied to War Office, Air Ministry, Admiralty, all leading Railways, and Industrial Organisations in all parts of the world.

## THE FLEXIBLE SHAFT MANUFACTURING CO.

(Sole Proprietors: F.S. ENGINEERING LTD.)

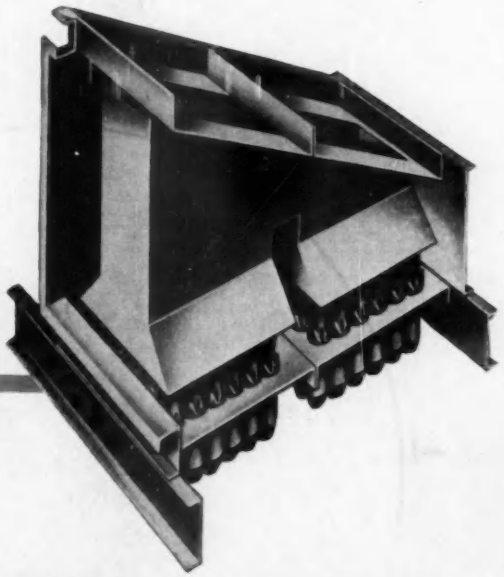
TOWN ROAD · EDMONTON · LONDON · N · 9

Telephone: Edmonton 3541. Telegrams and Cables: Flexotrans Southtot London.



## Electrostatic Precipitators

Made under licence from the Aerotec Corpn., U.S.A., these precipitators have an extremely high collection efficiency, low current consumption and many novel design features including screen-grid type collecting electrodes which minimise re-entrainment and consequent emission of dust. Manufactured in several combinations of width, height and length to suit available space in existing plants or most efficient usage of building volume in new constructions.



# PD–KB

## Multitubular Dust Collectors

Here is a dust collector which satisfies the ideal requirements of steam generator designers. It has a high collection efficiency at moderate resistance; maximum freedom from dust erosion; accessibility for maintenance and service; simple, low cost erection; flexibility of arrangement to meet space availability conditions. These collectors can be used in series with electrostatic precipitators and can be designed to match the precipitator inlet.

## Induced & Forced Draught and Grit Arresting Fans

The product of over 75 years of experience, 'Tornado' induced and forced draught fans can handle any boiler draught requirements efficiently and reliably. The type A.R. aerofoil section backward bladed centrifugal fan, with peak efficiency of 90%, is only one of the many types (another is the combined induced draught and grit arrester) produced to deal with all classes of boilers from central heating to those in the largest power stations.

## for CLEAN AIR

**KEITH BLACKMAN LTD**
*(Incorporating Blackman Export Co Ltd)*
MILL MEAD ROAD · LONDON N.17

*in collaboration with Prat-Daniel (Stanmore) Ltd., Whitecroft, Nailsworth, Gloucester*

TA.516/912

Proprietors and Publishers: Engineering Review Publishing Co. Ltd., Registered Offices, 19-20, Noel Street, London, W.1
Printed by Electrical Press Ltd., at Cordwallis Works, Maidenhead, Berks.
Registered for transmission by Magazine Post to Canada including Newfoundland.